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PSYCHOLOGICAL TESTS AND GUIDANCE OF HIGH SCHOOL PUPILS

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JOURNAL OF EDUCATIONAL RESEARCH MONOGRAPHS
No. 1 June, 1921

Psychological Tests and Guidance of High School Pupils

WILLIAM MARTIN PROCTOR

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JOURNAL OF EDUCATIONAL RESEARCH MONOGRAPHS

B. R. BUCKINGHAM, *Editor*

No. 1 June, 1921

The Use of Psychological Tests in the Educational and Vocational Guidance of High School Pupils

BY

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Bloomington, Illinois

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EDITOR'S INTRODUCTION

When Professor Terman's book on *The Intelligence of School Children* appeared, it became evident that Leland Stanford Junior University was the center of a surprisingly extensive investigation of human mentality. It was clear that records were being made, not once, but repeatedly, with reference to the same children and that many of these children were being kept under observation throughout their school careers and even beyond. In other words, the common curse of our educational inquiries, in virtue of which nothing is studied hard enough and long enough to reach fundamental results, seemed to have been lifted from the efforts of the Stanford group of men and women.

One of the members of the Stanford group is Dr. William M. Proctor, the author of this book. He has given particular attention to high-school pupils and to underclassmen in college and it is to these groups that he has applied his tests.

These tests are for the most part such as may be given to large numbers of persons simultaneously. Instruments of this kind have been appropriately called group tests, in contradistinction to the individual or interview tests in the use of which one examiner handles only one person at a time. The history of the development of these group tests to their present status has been sketched in a number of places. It is generally and correctly understood that the prototype of all the present group intelligence tests is the collection of examinations loosely termed the Army Tests.

From the Army Tests, either in direct descent or by collateral branches, has sprung a large progeny in the form of group intelligence scales or tests. The use of these tests has already become enormous. To a certain extent the persons who have devised them have become victims of this popularity. When the school people will buy and use these tests by the millions, there is a temptation for authors to rush them into print without sufficient preliminary analysis and without extensive trial in practical situations.

Of course, this is only a temporary condition. Out of the competition among different tests and the trials of two or more of them on the same individuals will come a critical literature which will surely bring untrustworthy instruments into disrepute. This sort of literature is only just now coming through. The development of group intelligence tests has been so rapid that books on their use have not had time to appear. Magazine articles involving the use of one or two of them have been published. Dr. Holley's monograph on the use of mental tests appeared during the past autumn. The present book is another of much the same sort. It deals with the Binet Scale, the Army Examinations *a* and *b*, and the Army Alpha Test.

But Dr. Proctor's book, although incidentally concerned with the validity of the different scales, is primarily devoted to the practical uses to which the results of intelligence testing may be put. For example, upon testing the same pupils after an interval of two and a half years, Dr. Proctor is especially interested in the fact that "the person who made the original tests . . . would have been in a position to give very helpful advice to all of the pupils tested by him; also that his predictions as to the possible educational future of each of these pupils would have deserved serious consideration by parents and teachers." Again, when it becomes possible to compare the success in high school of two groups of pupils of which one has received guidance on the basis in part of intelligence testing while the other has received no such guidance, Dr. Proctor is especially interested in this practical demonstration. About a third of the unguided pupils, but only one-fifth of the guided pupils, failed in one subject. None of the pupils who had received the benefit of guidance failed in two or more subjects, while rather more than one in ten of the unguided pupils failed to that extent.

In other directions his interest in the practical use of intelligence tests leads him into the field of vocational guidance. Here he makes good use of the work of the army psychologists by which the intelligence of recruits belonging to different occupations was revealed. These he relates to the occupational preferences which he obtained from over nine hundred high-school pupils. The lowest intelligence score made by the middle 50 percent of professional workers among the Army recruits was 98. On the other

hand, 50 of the high-school pupils who expressed their intention of becoming professional workers scored less than 90. Again, he points out the fact that over 60 percent of the high-school pupils aspired to join the ranks of the professional class while, according to the United States census, less than 5 percent of the gainful workers of the country belong to that class. Dr. Proctor, therefore, although not neglecting the theoretical and scientific aspects of his subject, gives particular attention to the practical bearings of it. Indeed, we should say that his monograph is a good example of a method of treatment, which, while it is competent from the point of view of research workers, is also of special interest to public school workers.

With respect to vocational guidance Dr. Proctor's material supports his view that those who seek a ready means of determining whether pupils should be telephone operators or photographers, bakers or blacksmiths, farm workers or barbers, are likely to be disappointed. Nothing in our general intelligence tests will enable us to be specific to this degree. If, however, occupations are divided into five or six general classes, the data at hand regarding the range of intelligence among people belonging to these classes are such as to permit us to say something definite concerning the class of work in which a given pupil may, so far as intelligence is concerned, be successful. Perhaps even here we can say with greater certainty what the class of occupations is in which the pupil will *not* be successful. For example, if a pupil's intelligence quotient is 90, we can be sure that his intelligence is not sufficient for professional work but that he may (if other conditions are favorable) successfully pursue some occupation belonging to the class of skilled labor. Whether that occupation shall be that of a bricklayer or a painter, a plumber or a carpenter, cannot be determined on the basis of intelligence. Such a determination will depend upon individual aptitude, preferences, and opportunities. In other words, we may with some safety advise pupils as to classes of occupations, but we cannot assume—at least on the basis of general intelligence—to advise them with respect to particular occupations within the occupational classes.

Those, therefore, who are looking to the intelligence test to determine whether a boy should be a bookkeeper or a telegrapher

may as well know at the outset that these tests offer no basis for such determinations. This comes about from the very simple fact that the same degree of general intelligence is required and is now being exhibited by both bookkeepers and telegraphers. In other words, the difference between the qualifications for workers of these two sorts is not intellectual in the general sense. Perhaps we shall subsequently develop trade and occupational tests which will differentiate more sharply than is now possible between the aptitudes pertaining to occupations in the same class. Indeed, we can already mark out in a general way the lines along which such investigation will proceed. There will be, in the first place—to stick to our bookkeeper and telegrapher—an analysis of the bookkeeper's job and the telegrapher's job for the purpose of finding out what these workers have to do. From these data some inferences may be made as to the specific abilities required in learning and performing the operations incident to the occupation. Having determined these abilities, or the most important of them, tests may perhaps be devised for measuring such abilities. Many trials of these tests and a checking of the results obtained from them against the ultimate success of persons who have become bookkeepers and telegraphers will be required in order to refine the tests to the point where they will be valid instruments. Meanwhile, one ought to point out that trade tests are quite different from guidance tests. For example, we have certain trade tests which have been developed in the army. We also have tests for clerks and stenographers. But all these tests are given to determine the ability of persons already belonging to the occupation or claiming to belong to it. A test to determine whether a person, prior to studying about an occupation or entering upon it, has the ability to pursue it successfully is quite another matter.

Dr. Proctor's chapter on the application of the Army Tests to freshmen upon entrance to college is especially interesting. It is worth noting how the different educational levels correspond to different intelligence levels. Dr. Proctor found, for example, that, expressed in terms of the intelligence quotient, the typical first-year high-school pupil has a mentality of 105. Three or four years later, when elimination throughout the high school has had its effect, the typical intelligence of high-school graduates

has gone up 6 points—namely, to 111. If the reader will recall Professor Terman's classification of intelligence quotients, he will observe that this means that more than half of the high-school graduates belong in the classification called "superior" or in a higher classification. Between graduation from high school and entering college another sharp elimination apparently takes place in virtue of which the mentality of typical students now moves up 4 points so that the median intelligence quotient for students entering college is 115. As Dr. Proctor points out, if the same process of selection takes place in college as in high school, "we should expect the median intelligence quotient of college graduates to be 120 or over." This means that students of no more than average intelligence will be likely to be eliminated from college before the senior year.

In conclusion, we should like to point out that Dr. Proctor makes no inordinate claims for the intelligence test. Some of the results—particularly the correspondences between intelligence scores and teachers' estimates and between intelligence scores and official ratings—would be higher if better tests had been at his disposal. The Army Alpha Test was not intended for high-school or college students. On this ground, and also because it was a pioneer and is capable of improvement, it is to be expected that future workers will secure even more significant correspondences than Dr. Proctor found. But whether this is true or not, the spirit of the author would no doubt remain the same—the spirit of scientific conservatism which refuses (to use his own words) "to place undue confidence in the results of a single psychological examination, however thoroughly it may have been standardized."

B. R. BUCKINGHAM

January 22, 1921

CHAPTER I

INTRODUCTION

The secondary school population of the United States has, since 1890, increased three times as fast as the general population. In the year 1915 there were 14.4 pupils of secondary grade for every 1,000 persons of the general population, whereas, in 1890 there were only five. According to recent estimates there are in the United States 14,000 high schools caring for 1,500,000 pupils requiring the services of 80,000 teachers, and calling for the expenditure of $75,000,000 per year for salaries and maintenance.

The problem of administering the physical side of this vast educational enterprise has occupied the attention of school authorities to such an extent that small consideration has been given to the need for internal betterment. The average American community is willing to tax itself for material equipment. An imposing high-school building becomes a matter of civic pride. It is a good talking point in chamber of commerce literature, and can be shown to visitors as an index of the progressive nature of the community.

Many of our city high schools are housed in buildings superior to those occupied by the best colleges and universities a generation ago. Buildings costing from $500,000 to $1,000,000 are not uncommon; and it is perfectly safe to say that no other nation has begun to spend as much upon its secondary school buildings as has our own.

When, however, it comes to securing more money for teachers' salaries, for enriching the curriculum, or other matters of internal improvement, the task is much more difficult. The results obtained by spending money to make a better adjustment between the child and the curriculum, or between the child and his future place in the social order, are quite intangible. It is very difficult to prove to the tax-paying public that money so spent will pay ascertainable dividends.

Since the public is more willing to spend money on buildings that can be seen than on invisible internal betterments, reforms in our secondary schools have come very slowly. Natural con-

servatism as well as considerations of economy have combined to sustain the traditional curriculum in seventy-five out of every hundred high schools.

So long as preparation for college was the chief end and aim of secondary education, the narrow, college preparatory course of study was satisfactory. But since the high-school population now comes from every class of home, and since only 10 percent of those who enter high school ever reach college, the demand has come to be more and more insistent that secondary education shall prepare the youth of the land for citizenship and vocations.

In the discussion of the proposed reorganization of secondary education large space is being given to the problem of educational and vocational guidance. The classical, college-preparatory, high school of former days had no need of educational guidance. There was only one course of study. It was a case of take it or leave it. Neither was there great need for vocational guidance. Those who could master the prescribed course of study were headed for the professions. Those who were unable to complete the course taught school or went back to the farm. The boy or girl in perplexity as to a life career could find wise and sympathetic counselors in the village minister, doctor, or lawyer.

The boy or girl of the present day faces a much more complex situation. The fields of vocational opportunity have been greatly multiplied. Where formerly there were six or seven possible lines of life work open to the educated man or woman, there are now literally hundreds. Some agency must take over the task of collecting, organizing, and imparting accurate information regarding possible vocational opportunities to the boys and girls in our high schools.

The necessary information is no longer easily accessible to the inquiring boy or girl. The "No Admittance Except on Business" sign bars them from shop and office alike. They have become more and more dependent upon imparted, as against first-hand, information concerning the qualifications necessary to success in the different fields of endeavor. The minister has been practically eliminated as a factor in vocational guidance, because the church reaches such a small fraction of the high-school population. A majority of parents have neither the disposition nor the means of acquiring adequate information regarding vocations to make them

competent counselors. This means that the home is a much less important factor than it used to be in the vocational guidance of youth.

The high school, therefore, becomes the residuary legatee of the church and the home in the field of educational and vocational guidance. Whether the high school meets its opportunity for service in this new direction or fails entirely to function will depend upon the methods of educational and vocational guidance adopted.

The vital nature of guidance in education is well stated by Truman Lee Kelley:[1]

> The modern idea of education is crystallizing into an effort to guide rather than to instruct—to answer a need rather than to cater to a curriculum. The growing recognition of the need of vocational and educational guidance is resulting in the establishment of bureaus endeavoring to give the former, and in the training of psychologists to solve the problems of the latter.

Also by J. M. Brewer:[2]

> The development of men and women is the purpose of the school, and the selection of and preparation for occupations is one of the important features of this development. The school must therefore be organized with the vocational guidance of the child as one of the aims in mind.

This monograph embodies the results of a recent study by the writer involving the use of psychological tests in the educational and vocational guidance of high-school pupils. The data gathered and the conclusions reached are presented in the hope that those interested in the advisement problem in the high school may find herein helpful suggestions or be stimulated to make constructive criticisms in the light of their own experience.

The study was begun in the school year 1916-1917. All the pupils of the September and February entering classes of the Palo Alto Union High School were given the Stanford Revision of the Binet Intelligence Scale. In 1917-1918 group tests, Army Examinations *a* and *b*, and Army Alpha Test, Form 5, were given to more than 1,600 high-school pupils, representing nine different institutions.

[1] Kelley, Truman Lee. *Educational guidance.* (Teachers College, Columbia University Contributions to Education, No. 71.) New York: Teachers College, Columbia University, 1914, p. 1.

[2] Brewer, J. M. *The vocational-guidance movement.* New York: Macmillan Company, 1918, p. 58.

The high-school progress of these pupils has been noted; information as to vocational ambition, educational plans, etc. have been secured; teachers have been asked to give estimates of ability; and the school marks of those remaining in school have been obtained. The records made by 93 pupils who were graduated from high school subsequent to being given the psychological tests, and who entered Stanford University, have also been compiled.

The following chapters will indicate what the writer found to be the value of the tests as a means of predicting probable high-school, vocational, or university success. The word "probable" is used advisedly because it should be stated at the outset that the writer is not disposed to place undue confidence in the result of a single psychological examination, however thoroughly it may have been standardized.

The results obtained are at least suggestive of the methods of procedure, in the use of psychological tests by the high-school principal or teacher, that will throw the most light upon the problem of educational and vocational guidance in the high school.

CHAPTER II

PSYCHOLOGICAL TESTS AS A MEANS OF MEASURING THE PROBABLE SCHOOL SUCCESS OF HIGH-SCHOOL PUPILS

The validity of the Stanford-Binet Scale, when applied to high-school pupils, has already been discussed by the writer in the issues of *School and Society* appearing October 19, and 26, 1918.[1] In those articles it was shown that very significant correlations had been obtained between intelligence quotients,[2] (I. Q.'s), resulting from the individual tests of 107 high-school pupils and the school marks earned by the same pupils during the school year, 1916-1917; also between I. Q.'s and teachers' estimates of intelligence made during the same year.

Two years and a half later there were 66 of the original 107 high-school pupils remaining. Teachers who had known all of these pupils during their stay in the high school were asked to give estimates of their intelligence upon the same rating sheet as that which was used in 1916-1917. All school marks earned during the two and one-half years were averaged. Correlations were then found (a) between the I. Q.'s obtained in 1916-1917 and the teachers' estimates made in 1919; (b) between the average of all school marks earned up to April 1, 1919 and I. Q.'s obtained in 1916-1917; and (c) between the average school marks and the teachers' estimates made in 1919. Table I shows the close agreement between the correlations obtained in 1916-1917 and those found in 1919.

Table I shows that the correlations obtained in 1918-1919, when the same comparisons were made as in 1916-1917, were

[1] Proctor, W. M. "The use of intelligence tests in the educational guidance of high-school pupils," *School and Society*, 8:473–78, 502–9, October, 1918.

[2] The intelligence quotient is obtained by dividing the mental age by the chronological age. Thus a twelve-year-old chronologically who tested eight years old mentally would have I. Q. of 0.66, expressed for convenience "66." The I. Q. is an index of relative brightness. For further discussion of intelligence quotient see: Terman, L. M. *The intelligence of school children*. New York: Houghton Mifflin Co.. 1919, p. 7.

TABLE I. COMPARISON OF CORRELATIONS OBTAINED IN 1916-1917 WITH THOSE OBTAINED IN 1918-1919[a]

Year	Correlation between I. Q. and Teacher Estimates	Correlation between I. Q. and School Marks	Correlation between School Marks and Teacher Estimates	Total Number of Cases
1	2	3	4	5
1916–17.....	0.586±0.043	0.545±0.046	0.702±0.033	107
1918–19.....	0.583±0.055	0.487±0.063	0.667±0.046	66

[a] Pearson's formula[3] (shorter method) was used in making all correlations.

practically as high as those obtained in the first instance. The results of two and one-half years of follow-up work seem to indicate that the person who made the original tests with the Stanford-Binet Scale in 1916-1917, would have been in a position to give very helpful advice to all of the pupils tested by him; also that his predictions as to the possible educational future of each of these pupils would have deserved serious consideration by parents and teachers.

As a means of discovering individual differences between school children in order that they may be grouped in classes according to ability, the individual psychological test has been shown to be a helpful tool. From the standpoint of school administration, however, the individual test presents serious difficulties. The time required to give an individual test to a high-school pupil varies from 40 minutes to 120 minutes. The total number of pupils that can be examined by a single examiner in a day will seldom exceed ten. The use of the Stanford-Binet abbreviated scale enables an examiner to test from 15 to 25 pupils in a day. Even so, it is impossible to use the individual method when a rapid survey of an entire school population is to be undertaken.

Group mental examinations afford the only means of meeting the demand for a speedy and reliable method of measuring the mental abilities of large groups of people. Under the supervision

[3] Rugg, H. O. *Statistical methods applied to education.* New York: Houghton Mifflin and Co., 1917, p. 274.

of Dr. L. M. Terman the writer directed the giving of Examination *a* (Form A) and Examination Alpha (Form 5) of the Army Scale to 1,349 high-school pupils, representing eight California high schools, during the school year 1917-1918.

Examination *a* consists of ten tests: (1) Oral Directions, (2) Memory for Digits, (3) Disarranged Sentences, (4) Arithmetical Reasoning, (5) Information, (6) Synonym-Antonym, (7) Common Sense, (8) Number Series Completion, (9) Analogies, (10) Number Comparison. The total possible raw score is 237. This test was given to portions of the first-year high-school classes in the Oakland Technical, Oakland Central and Fremont, Oakland, high schools and to all of the pupils present on the day of the examination at the Palo Alto Union High School. The total number of pupils was 715.

Group Examination Alpha consists of eight tests: (1) Oral Directions, (2) Arithmetical Reasoning, (3) Practical Judgment, (4) Synonym-Antonym, (5) Disarranged Sentences, (6) Number Series Completion, (7) Analogies, (8) Information. This test was given to all pupils present on the day of examination in the San Mateo, Redwood City, Mountain View, and Santa Clara union high schools. The total number of these pupils was 624.

These group mental examinations were applied to all of the pupils in each of the high schools enumerated above at exactly the same time. A sufficient number of examiners, trained by Dr. Terman, were taken to each high school, to cover the entire high school in one forty-five minute period. The size of the groups ranged from 40 to 150. It took the writer and his assistant a total of 134 hours to test 107 high-school pupils by the individual method. Six trained examiners were able to give Examination *a* to 350 Palo Alto high-school pupils in 45 minutes. The test blanks were scored by university students. Their work was carefully checked and the results tabulated by the writer.

Group Test Results Compared with Individual Test Results

One hundred and sixteen of the high-school pupils tested with Examination *a* had previously been given the Stanford-Binet Scale. Table II makes comparison of the two kinds of mental examination. Although no Binet I. Q.'s are found in the group 140-149, six Army Scale I. Q.'s are between 140 and 149. This

is because a higher mental age is attainable on the Army Scale than on the Binet Scale. For example, a high-school boy fifteen years and two months old passed every test in the Stanford-Binet

TABLE II. RELATION BETWEEN THE I. Q.'S OF 116 HIGH-SCHOOL PUPILS EARNED ON THE STANFORD-BINET SCALE AND THE I. Q.'S OF THE SAME PUPILS EARNED ON EXAMINATION *a*, ARMY SCALE

I. Q.'s on Stanford-Binet Scale	I. Q.'s on Examination *a*, Army Scale							Totals
	80–89	90–99	100–109	110–119 (*Median*)	120–129	130–139	140–149	
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
130–139	.....	.....	.....	.....	3	3	5	11
120–129	.....	.....	1	3	7	9	1	21
110–119 (*Median*)	.....	2	8	11	9	2	.....	32
100–109	.....	.....	13	3	4	.....	.....	20
90–99	.....	7	11	8	.....	.....	.....	26
80–89	.....	5	.....	.....	.....	.....	.....	5
70–79	1	.....	.....	.....	.....	.....	.....	1
Totals	1	14	33	25	23	14	6	116

Median for Binet I. Q.: group, 110-119
Median for Army Scale I. Q.: group, 110-119
Correlation, Pearson's formula, 0.736; P. E., 0.029

Scale, thus earning a mental age of nineteen years and six months, and an I. Q. of 129. On the Army Scale, Examination *a*, he made a raw score of 219, corresponding to a mental age score of twenty-one years and eleven months, and an I. Q. of 144.[4] In other words, the Stanford-Binet Scale does not give the superior high-school pupil an opportunity to earn as high an I. Q. as he can earn on the Army Scale. This factor would tend to lower the

[4] Mental age norms for both tests of the Army Scale were worked out by Dr. Samuel Kohs and the writer. It was found that about fifteen points of raw score on Examination *a* and Examination Alpha corresponded roughly to a mental age year. Possible raw score, Examination *a*, 237, possible mental age twenty-three years; possible raw score, Alpha 212, possible mental age 23 years and 2 months. See Appendix.

correlation between the two sets of I. Q.'s. The correlation obtained in Table II (+0.736) is a strong indication that if the Stanford-Binet Scale is a valid means of finding the mental level of high-school pupils, the Army Scale Examination *a* is also valid for the same purpose.

Army Scale Results Compared with High-School Marks

The school work of all the high-school pupils examined by means of the two army group tests was carefully followed up for the school years 1917-1918 and 1918-1919. The marks given were reduced to a comparable basis by assigning arbitrary values to each type of mark employed by the various high schools. Thus an "A" or a "1" was given a value of 95; a "B" or a "2," a value of 85, etc. Letters or numbers with plus and minus signs were given intermediate values. All of the marks earned by a given pupil were averaged, but no case was included in the tables unless the marks for at least two semesters of school work, the equivalent of one year, were available.

1. *Army Scale, Group Examination* a.—Table III makes a comparison between the I. Q.'s obtained from the Group Examination *a* and the quality of high-school work of 494 high-school pupils. The total number taking the test was 715, but only 494 cases had ratings for one year of school work.

Since the correlation obtained (+0.343) is 12.8 times the indicated P. E., it has considerable significance. While it is not as high as the correlation between Binet I. Q.'s and school marks found in Table I, there are several factors which may have tended to lower the correlation. The army tests were designed for use with soldiers in cantonments. Many of the questions have to do with matters of common knowledge about a military camp, but with which high-school pupils have no acquaintance. This would especially affect the scores of high-school girls. There are twenty cases falling in I. Q. groups below 95, where the indicated school work is of a quality of 80 percent or above, and fifteen of these cases, or 75 percent, are girls.

Another factor which may have tended to lower the correlation is the skewness of the school marks curve toward the high percents. The median school marks group in Table III is 80-84.

TABLE III. CORRELATION BETWEEN THE I. Q.'S OF ARMY GROUP EXAMINATION *a* AND THE QUALITY OF SCHOOL WORK OF 494 HIGH-SCHOOL PUPILS

School Marks	Army Group Examination *a* I. Q.'s										Totals
	84 or Lower	85–89	90–94	95–99	100–104	105–109 (*Median*)	110–114	115–119	120–124	125 or Above	
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
90 or above	.....	....	3	2	2	3	6	6	6	6	34
85–89	.....	.....	5	9	18	24	22	24	8	4	114
80–84 (*Median*)	1	2	9	28	41	46	30	13	9	3	182
75–79	1	3	9	19	19	19	19	7	2	.....	98
70–74	2	3	4	14	11	11	7	1	1	.....	54
65–69	.....	1	1	4	1	1	2	1	.....	.....	11
55–64	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	.....
Totals	4	9	31	76	92	105	86	52	26	13	494

Medians: I. Q.'s, group 105–109; school marks, group 80–84
Semi-interquartile ranges: I. Q.'s, 6 points; school marks, 4½ percent
Correlation, Pearson's formula, 0.343; P. E., 0.027

This represents a grade of "B" or "2." It is necessary for these high-school pupils to receive marks of "B" or "2" in all subjects required for university recommendation. The Palo Alto high school is in close proximity to Stanford University, and the Oakland high schools are in the immediate vicinity of the University of California. The fact that 68.8 percent of the grades given to these 494 high-school pupils were "B" or above is an indication that teachers were influenced in their marking by the demand for "B" grades for university recommendation. Many pupils with just *average* ability were given marks ranking *superior*. Hence there might be a rather wide difference between their mental ability as shown by the tests and their school progress as shown by their marks.

2. *Army Scale, Group Examination Alpha.*—Table IV compares the I. Q.'s of 480 of the high-school pupils of San Mateo,

Redwood City, Mountain View, and Santa Clara with their school marks. There were 624 pupils belonging to these high schools who took Examination Alpha, but only 480 cases came under the rule requiring ratings for one whole year of school work.

TABLE IV. CORRELATION BETWEEN THE I. Q.'S OF THE ARMY GROUP EXAMINATION ALPHA AND THE QUALITY OF SCHOOL WORK OF 480 HIGH-SCHOOL PUPILS

School Marks	Army Group Examination Alpha I. Q's.										Totals
	84 or Lower	85–89	90–94	95–99	100–104	105–109 (*Median*)	110–114	115–119	120–124	125 or Above	
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
90 or over	.....	.....	.....	3	3	15	12	9	9	5	56
85–89	.....	.....	.....	8	17	15	24	13	6	6	89
80–84	.....	.....	4	6	22	21	20	10	5	1	89
75–79 (*Median*)	.....	.....	7	25	33	23	10	7	4	.....	109
70–74	.....	4	10	18	14	22	12	1	1	.....	82
65–69	1	3	3	12	7	8	8	1	.....	.....	43
55–64	.....	.....	2	5	3	1	1	.....	.....	.....	12
Totals	1	7	26	77	99	105	87	41	25	12	480

Medians: I. Q.'s, group 105–109; school marks, group 75–79
Semi-interquartile ranges: I. Q.'s, 6 points; school marks, 6½ percent
Correlation, Pearson's formula, 0.413; P. E., 0.026

The correlation obtained in Table IV (+0.413) is 15.9 times the indicated P. E. and 0.07 higher than the correlation found in Table III. The higher correlation found in this table may be due to the fact that Examination Alpha was the result of careful revision of the first series of tests in the light of preliminary experimentation in three army cantonments and the returns from the tests of several thousand school children. Also, the high schools in which Examination Alpha was applied were not in such close proximity to universities as were the high schools represented in Table III. The group median for school marks is 75-79, and only 48.8 percent of the ratings given in these four high schools ranged as high as "B" or over.

When account is taken of the possible reasons for the difference in the correlations as shown in Tables III and IV, it is safe to say that they are of approximately equal value. For use in the public schools Examination Alpha is the better scale, because it consists of but eight tests, can be given in less time, is scored more rapidly, and costs less to print.

Individual and Group Mental Tests as Means of Indicating Probable Retention or Elimination of High-School Pupils

1. *Elimination among pupils tested with the Stanford-Binet Scale.*—On the first day of April, 1919, it was found that 41 of the original 107 pupils tested in 1916-1917 with the Stanford-Binet Scale had dropped out of school, leaving 66 still in attendance. Table V gives the distribution of the 107 cases, showing the I. Q.'s of pupils who left high school to go to work, of pupils who were transferred to other high schools, and of pupils who still remain in the same high-school.

TABLE V. DISTRIBUTION ON APRIL 1, 1919, OF 107 HIGH-SCHOOL PUPILS TESTED WITH STANFORD-BINET SCALE IN 1916–1917

Binet I. Q.'s Earned in 1916–1917	Total Number of Cases	Distribution April 1, 1919, by Percents		
		Out at Work (%)	Out, Transfer'd to Other High Schools (%)	Remaining in Same High School (%)
1	2	3	4	5
79 or lower.....	1	100	0	0
80–89.....	7	72	14	14
90–99.....	29	31	9	60
100–109.....	27	22	22	56
110–119.....	22	0	27	73
120–129.....	15	0	13	87
130 or above.....	6	0	33	67
No. of cases.....	107	21	20	66
Median I. Q.'s.....	.....	94	110	110

The only pupil testing below 80 I. Q. dropped out at the end of the first semester of 1916-1917 to go to work. All of those in group 80-89 who left school to go to work, did so by the end of the first year. Failure in school work has been recognized as the most fruitful cause of elimination from high school, but the relation between mental ability and failure in school work has not heretofore been given due consideration. At the end of two and one-half years none of those testing below 80, and only 28 percent of those testing 80-89 remain in high school. On the other hand, 100 percent of those testing 110 or over are pursuing their studies either in the Palo Alto high school or in other high schools. When the average school ratings of the different groups is taken into account the close connection between mentality and elimination will be still more apparent. The average school rating of the 21 who left school to go to work was 73 percent; of the 20 transferred to other high schools, 77 percent; and of the 66 remaining in the Palo Alto high school, 79 percent.

2. *Elimination among pupils tested with the Army Examination* a *and Alpha.*—Only five of the eight high schools where the Army Scale was applied were selected for follow-up work in connection with elimination because the records of the three Oakland high schools did not indicate whether the pupil leaving had been transferred to another high school or had gone to work. In the case of the Palo Alto, San Mateo, Redwood City, Mountain View, and Santa Clara high schools, it was comparatively easy to secure reliable data with reference to every pupil who took the test. The principals of all these schools had served in their respective positions from four to fourteen years, knew their pupils thoroughly, and had on record information concerning the movements of those who had left school since the giving of the Army Tests in 1917–1918.

Table VI gives for those tested with the Army Scale a distribution similar to that contained in Table V for the 107 tested with the Stanford-Binet Scale. The 955 pupils of the five high schools above mentioned have been distributed by I. Q.'s into four groups: (1) those who left high school to go to work; (2) those who transferred to some other high school; (3) those who graduated; (4) those remaining in high school on April 1, 1919. The follow-up work covered one and one-half years of school work. Figure 1 illustrates graphically the data of Table VI.

TABLE VI. DISTRIBUTION OF 955 HIGH-SCHOOL PUPILS ON APRIL 1, 1919, WHO WERE TESTED WITH ARMY TESTS IN 1917–1918 BY I. Q. GROUPS

Army Scale I. Q.'s Earned 1917–1918	Total Number of Cases	Distribution on April 1, 1919, by Percents			
		Out at Work (%)	Out, Transferred to Other High Schools (%)	Out by Graduation (%)	Remaining in Same High School (%)
1	*2*	*3*	*4*	*5*	*6*
79 or lower....	13	61.5	7.7	0.0	30.8
80–89.....	73	34.3	8.2	5.5	52.0
90–99.....	202	26.2	8.9	11.4	53.5
100–109.....	283	12.3	8.8	14.1	64.8
110–119.....	221	4.0	14.5	23.0	58.5
120–129.....	101	6.9	11.8	19.8	61.4
130 or over....	62	1.6	9.8	24.6	64.0
No. of Cases..	955	138	100	153	546
Median I. Q.'s.	.....	96	110	111	107
Percent I. Q.'s below 100...	.....	62.4	25.0	17.6	26.5

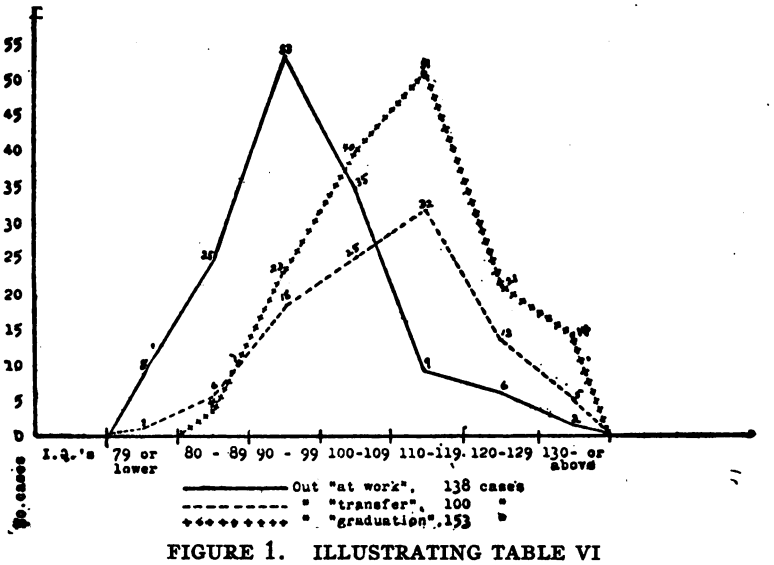

FIGURE 1. ILLUSTRATING TABLE VI

In this table there appears to be a strong confirmation of the findings of Table V, as the following comparison will show:

TABLE VIA. MEDIAN I. Q.'S BY GROUPS

	Out at Work	Out, Transferred to Other High School	Remaining in Same High School
1	2	3	4
Table V.....	94	110	110
Table VI.....	96	110	107

TABLE VIB. PERCENT OF PUPILS IN EACH GROUP WHOSE I Q.'S WERE BELOW 100

	Out at Work	Out, Transferred to other High Schools	Remaining in Same High School
1	2	3	4
Table V.....	71.4	20.0	27.0
Table VI.....	62.4	25.0	26.5

The agreement between the two tables is the more striking when it is remembered that the 107 high-schools pupils of Table V were all first-year pupils when the tests were given, while the 955 pupils of Table VI comprise all the classes of five different schools.

The tendency, noted in the discussion of Table II, for girls to make lower scores on the Army Scale than boys accounts for the 5.5 percent of pupils with I. Q.'s of 80-89 who appear in the "out by graduation" group. These four pupils were all girls, and their average rating in school work was 83 percent.

Table VII indicates how school marks tend to correspond to mental level as indicated by I. Q.'s earned in the Army tests.

Considering the "at work" cases, it appears that only the three highest I. Q. groups were doing a passing grade of work. Lack of mental ability was perhaps the most potent cause of elimination, but it was not the only cause operating in these cases. When interest in the subjects offered, application, and ambition are lacking, high scores in the mental tests are not necessarily a

TABLE VII. AVERAGE SCHOOL MARKS OF 955 HIGH-SCHOOL PUPILS, DISTRIBUTED ACCORDING TO THE CAUSES OF LEAVING

Cause of Leaving	79 I. Q. or Lower	80–89 I. Q.	90–99 I. Q.	100–109 I. Q.	110–119 I. Q.	120–129 I. Q.	130 I. Q. or Higher	General Average
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
At work.....	65	64	72	66	70	75	87	71.3
Transferred.....	59	67	76	72	82	85	86	75.3
Graduated	.....	83	79	84	85	84	92	84.5
Average marks by I. Q. groups.....	62.0	71.3	75.6	74.0	79.0	81.3	88.3	77.3

guarantee of school success. Turning now to the pupils transferred to other high schools, it appears that they made better average marks under every I. Q. group, except the very lowest, than did the "at work" pupils; but it is evident that some of them transferred to other high schools because of failure in school work. Later checking up will no doubt find them out of school entirely. All of the cases in the "out by graduation" group show high average school marks, even those whose I. Q. is between 80 and 89. These are the same four cases discussed in connection with Table VI. They illustrate how necessary it is for those employing mental tests to be conservative in accepting the results of any single test as final.

When the school marks earned by all of these "out" groups are averaged a series of marks is obtained, ascending gradually from the lowest to the highest I. Q. ratings, which indicates a definite tendency for the quality of school work to correspond to the mental level indicated by the Army tests.

A further following-up of the 153 who graduated from the five high schools between September, 1917 and April, 1919, brought out the fact that 94 of them were continuing their education in college, university, or normal school. The median I. Q. of those going on to higher educational institutions was found to be 116. One high-school girl, who earned an I. Q. of 140 on the Army Scale, graduated from the San Mateo high school at the age of fourteen years and five months. Because of the minimum age

limit of fifteen years for entrance to the university, she was compelled to wait seven months before continuing her education. Had her case been included in the "at college" group, the median I. Q. would have been 118.

Taking into account all of the cases of high-school pupils tested either by the individual or group method of mental examination we find the following ascending scale of median I. Q.'s as a further indication that the psychological tests disclosed the *approximate* mental level of the cases discussed in the foregoing tables: first-year high-school pupils, median I. Q., 105; high-school graduates, 111; those going on to college, 116.

Summary

1. Individual and group mental tests of the types described have been shown to be sufficiently reliable to justify their use as aids in determining the mental level of high-school pupils.

2. Group tests, such as Army Scale Examinations *a* and Alpha, make possible a preliminary mental survey of an entire high-school population at the beginning of a school year. The resulting raw scores will be found to be of great value in grouping the pupils according to ability. Such tests should a ways be supplemented with every other possible means of discovering the mental level. The results should be considered tentative and subject to revision in the light of later developments.

3. The high-school principal who makes such a preliminary mental survey of his pupils can be reasonably sure that 50 percent of those who test below normal will be eliminated within the first two years; that 25 percent additional of the subnormal group will have been transferred to other high schools because of failure in their school work; and that a negligible number will ever graduate. With this information at hand he can plan the curriculums of his pupils more intelligently. Discovering at the outset that from 15 to 30 percent of his pupils are incapable of succeeding in the conventional high-school subjects, he will undertake to make new adjustments to meet the situation. There will be fewer failures; more pupils will remain to take work that is adapted to their needs and capacities; and the high school will be less open to the charge of catering only to the intellectual aristocracy among its pupils.

CHAPTER III

THE USE OF PSYCHOLOGICAL TESTS IN THE EDUCATIONAL GUIDANCE OF HIGH-SCHOOL PUPILS

In the previous chapter the writer has shown that there is a very close relationship between intelligence level and the elimination of pupils from high school. There are good grounds for the prediction that 75 percent of those who test below average, mentally, will fail in more than one-half of their studies during their first year of high school; that 50 percent of them will leave school to go to work during the first two years; and that none of them will remain to graduate. The members of this group demand special attention. If they are not carefully guided in the selection of their high-school work many of them will fail in all of their subjects during the first semester, with elimination as the inevitable result.

Heretofore we have acted upon the assumption that the only way to discover the capabilities of high-school pupils was to permit them to try themselves out in various subjects of the high-school curriculum. It has even been a common practice to require all first-year high-school pupils to take an abstract subject like algebra. Thus many a promising educational bark has gone down on the uncharted rocks of the first-year high-school subjects.

Experimentation with psychological tests has now reached a stage where we can begin to hope that this wasteful trial and error method of procedure is to be discarded for a more scientific plan of educational guidance. No tests have yet been devised, either mental or pedagogical, which enable the adviser to chart unerringly the educational possibilities of a given youth, but we have made sufficient progress in mental measurements to be able to estimate with approximate accuracy the probable school success of a given pupil. The results of a practical experiment in educational guidance by means of mental tests will be described in the following pages.

Conditions Surrounding the Experiment

The mid-year VIIIA class of the Palo Alto intermediate school comprising 31 pupils was examined with the Stanford-Binet

Scale in January, 1918. Figure 2 shows the distribution of intelligence quotients by chronological age groups. There were twelve thirteen-year-old pupils, eight fourteen-year-old, seven fifteen-year-old, and four sixteen-year-old pupils examined. The lowest I. Q. discovered in the thirteen-year-old group was 110. All of the thirteen-year-olds were, therefore, accelerated mentally. None of the fourteen-year-old group fell below 95 I. Q. They were all at or above age mentally. One fifteen-year-old had an

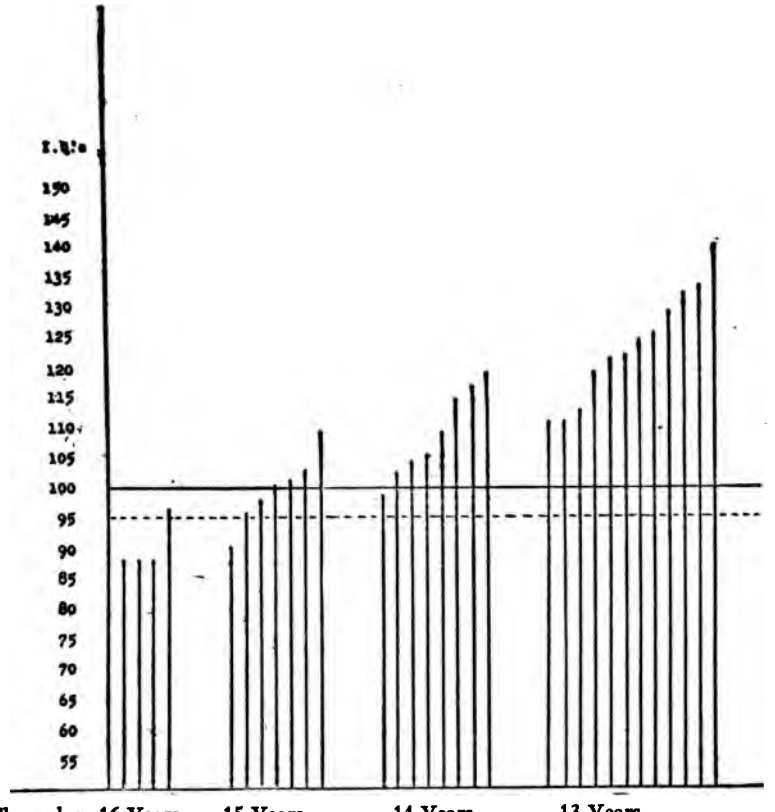

FIGURE 2. ILLUSTRATING DISTRIBUTION OF VIIIA[1] PUPILS BY I. Q.'S AND CHRONOLOGICAL AGES

[1] In grade designations "A" means "second half."

I. Q. of 90 and would be listed as "below average" in intelligence. Of the four sixteen-year-old pupils, all of whom would be accounted chronologically retarded, three had I. Q.'s of 88, and one an I. Q. of 96. That is to say, one of the sixteen-year-olds was normal and three would rate as "dull-normal."

Of the 31 members of the VIIIA class, 22 entered the Palo Alto high school in February, 1918. Four members of the class entered secondary schools elsewhere, two entered business colleges, two went to work, and one, a girl with an I. Q. of 88, eloped with a soldier from a nearby encampment.

Only four members of this VIIIA class had earned I. Q.'s below 95. One of these, as just indicated, did not enter high school. The remaining three entered high school, but two of them dropped out before the end of the first year. The percent of elimination from the class of those who tested below 95 I. Q. was therefore 75.0. The one who remains in high school is making an average record in scholarship. She made a rating of "average" on an Army Test given a few weeks later, and has shown herself capable of diligent application to her school work.

Each member of the class was questioned as to his or her vocational ambition, educational plans, and the subjects which he or she would like to take up during the first year of high school. These data, as well as results attained in Stanford-Binet and Army mental tests, were recorded on cards.

Use Made of Information Gathered

The cooperation of the vice-principal and entering class adviser was obtained in order that the members of the VIIIA class might receive intelligent educational guidance when they entered the high school. Duplicate sets of cards were prepared for the use of these persons. On registration day all the newly entered VIIIA graduates were referred to the vice-principal or the class adviser for help in making out their curriculums. No one was permitted to file a study card without this conference.

Following are samples of the cards used in this experiment in educational guidance. The only change from the original is in the case of the name.

CARD NO. 1

Smith, Jane

Chronological age: 13 yrs., 9 mo.

Score Army Scale...151

Stanford-Binet mental age: 16 yrs., 3 mo.

Army Scale mental age: 17 yrs., 5 mo.

Army Scale I. Q.....124

Stanford-Binet I. Q.....118

High school subjects which pupil desires to take:

Sewing
French
History
Typewriting
Piano

Educational plans: To finish high school and take business college course.

Vocational ambition: To be a stenographer or bookkeeper.

Grade of work done in intermediate and grammar schools: "B" and "B+"

Comment of Examiner: If assigned to algebra can safely be placed in first "rapid progress" division.

Jane Smith was advised to take subjects that would make it possible for her to go on to college as well as to carry out her ambition to become a stenographer. She took up: English German, algebra, and typewriting. During the first semester of her high-school course she made an average of "B" in all of her subjects.

Card No. 2 relates to Mary Jones who took exactly the subjects outlined on her card, except that being a first-year pupil she was permitted to take four subjects only and had to wait until her second year for drawing. At the end of the first semester in high school she had earned three "A" grades and a "B+," with an average of 93 percent.

Here was the case of a girl with very superior ability as indicated by two different mental examinations, by her school record and by the estimates of her elementary and intermediate school teachers. She gave evidence of being an independent thinker, of knowing

CARD NO. 2

Jones, Mary

Chronological age: 13 yrs., 1 mo.

Score Army Scale...148

Stanford-Binet mental age: 17 yrs., 2 mo.

Army Scale mental age: 17 yrs., 2 mo.

Army Scale I. Q....131

Stanford-Binet I. Q.....131

High school subjects which pupil desires to take:

English
Algebra
Latin
History
Drawing

Educational plans: To finish high school and attend a university or normal school.

Vocational ambition: To become a drawing teacher.

Grade of work done in grammar and intermediate schools: "A"

Comment of Examiner: Knows just where she is going and how to get there. May safely be permitted to select her own course of study. Assign to first division in algebra.

just what she wanted to make of herself, and just what she would have to do by way of preparation. The necessity for educational and vocational guidance in her case might well be questioned. However, it was a real advantage to her teachers to know at the very beginning of her high-school career the quality of her ability and something of her life plans in order that they might give immediate and sympathetic cooperation. Without this knowledge they might have made the mistake of holding her back to the pace of the "average" pupil. Fortified by the facts relative to her mental gifts and vocational ambitions, she is to be permitted to complete her high-school course in three years.

There is just as much danger that the bright pupil will not be given enough to do, as that the dull pupil will be given tasks that are too difficult to perform.

CARD NO. 3

Roe, Richard

Chronological age: 14 yrs., 4 mos.

Score Army Scale...150

Stanford-Binet mental age: 16 yrs. 9 mo.

Army Scale mental age: 17 yrs., 4 mo.

Army Scale I. Q....120

Stanford-Binet I. Q.....117

High school subjects which pupil desires to take:
English
History
Algebra
French

Educational plans:
To finish high school then attend a university or the U. S. naval academy.

Vocational ambition: Chemical engineer or naval officer.

Grade of work done in elementary and intermediate schools:
Very poor. Estimated as "average" by some grade teachers, and as "below average" by others.

Comment of Examiner: Boy has ability but needs to be waked up. Suggest that he take general science in place of history for first year. Also suggest that he be placed in first division in algebra where he will have to work. He will need to develop ability in both science and mathematics if he is to follow his vocational ambition.

The boy whose card is set forth above enrolled for English, algebra, history, and general science, upon entering high school. During his first half year he made grades of "C" in English, and "B" in each of his other subjects. This was a great improvement over the grades earned by him in the eighth grade. A recent

checking up shows that he has brought up his English grade and is maintaining college recommendation standing in all his work. The mental tests were an aid to his advisers in discovering how to spur him on to creditable achievement in his school work.

CARD NO. 4

Brown, Carrie

Score Army Scale... 100

Army Scale mental age: 14 yrs., 0 mo.,

Army Scale I. Q.....89

Chronological age: 15 yrs., 7 mo.

Stanford-Binet mental age: 14 yrs., 2 mo.

Stanford-Binet I. Q.....90

High school subjects which pupil desires to take:

English
Algebra
Latin
Typing
Drawing

Educational plans: To go to Mills College

Vocational ambition: To be a Chemist.

Grade of work done in intermediate and grammar schools: Grades in 8A class only fair, even in work that is being repeated. Estimates of elementary and intermediate teachers: "slow" but a conscientious worker.

Comment of Examiner: Should be discouraged as to taking Latin. Algebra doubtful, but if she insists in view of desire to go to college, assign to second division.

The program finally worked out by Carrie Brown and the class adviser included English, algebra, free-hand drawing, and typing. Her grades at the end of the first semester in high school were: English, "C"; algebra, "E" (failure); free-hand drawing, "C"; typing, "B." She had failed in algebra, the subject counted as doubtful by the examiner, and had earned less than college recommendation grades in the only other subjects that would be counted

toward entrance to Mills College. Even if she completes high school her chance of continuing in college is not at all bright.

A sufficient number of sample cards have been described to illustrate the method employed. There was no coercion. Counsel and advice in the selection of subjects were all that was attempted, but the counsel and advice offered were based on all the significant information with regard to mental ability, school success, vocational ambition, and teachers' estimates of ability, that could be obtained. Certain pupils elected to take subjects which the advisers felt sure they would fail in and made passing grades. Others taking subjects on the advice of the counselors failed. Such cases simply illustrate the truth that no human agency, however fortified with information or however careful to mix common sense with theories, can hope to be infallible. The general results of the experiment, however, were very satisfactory.

Results Attained by "Guided" and "Unguided" High-School Pupils

The original group of 107 high-school pupils which entered the Palo Alto high school in September, 1916, were examined with the Stanford-Binet Scale after entering high school. They had already selected their courses of study at the time of being examined, hence can properly be designated as the "unguided" group. A comparison of the first year's work done by the members of the "unguided" group with the work done by the group of 22 that entered high school in February, 1918, and which had the benefit of counsel based on mental tests and other significant data, will illustrate the value of careful guidance as against the trial and error method of selecting high-school courses of study.

TABLE VIII. COMPARATIVE FACTS REGARDING "GUIDED" AND "UNGUIDED" GROUPS OF HIGH-SCHOOL PUPILS

Group	Out at Work	Per-cent	Out by Transfer	Per-cent	Failed 1 Subject	Per-cent	Failed 2 or More	Per-cent
Guided....	1	4.5	2	9.1	4	18.2	0	0.0
Unguided..	21	19.6	20	18.6	33	30.8	11	10.3

It is not exactly true to fact to designate the original group of 107 as the "unguided" group. Most of them had been examined

with the Stanford-Binet before the end of the first six-week period. Whenever the results of the first six weeks of school work confirmed the indications of the mental tests that a pupil would probably fail in such abstract subjects as algebra, Latin, etc., that pupil was permitted to drop the subject and continue the semester carrying but three subjects. The subject dropped at the end of the first six-week period was not counted as a failure in compiling the data for Table VIII. The mental tests were utilized to aid in correcting the mistakes made by the pupils in the unguided selection of their subjects. To this extent, then, the original group was guided, but the guidance came after, not before school work was begun.

The number of failures registered against the "unguided" group at the end of their first year in high school would undoubtedly have been greatly increased if it had not been for the limited guidance above described. This fact gives greater significance to the data presented in Table VIII.

The median I. Q. of the unguided group was 105, and the median I. Q. of the guided group was 108, a difference of three points in favor of the guided group, but this is not in itself an adequate explanation of the superior record made by the guided group during its first year in high school.

The most significant facts to be found in Table VIII are those relating to number of failures in one subject, and in two or more subjects. It appears that 30.8 percent of the unguided group failed in one subject, and 10.3 percent failed in two or more subjects during their first year in high school, while of the guided group only 18.2 percent failed in one subject and none of them failed in two subjects. Since it has been shown that failures in school work tend to increase the percent of elimination it is reasonable to attribute the small percent of elimination due to leaving high school to go to work, in the case of the guided group, to entire absence of failures in two or more subjects.

The results of the above described experiment in educational guidance by means of mental tests would seem to justify the conclusion that such tests may be of material assistance to the high-school administrator, if used in connection with other significant data. It is certain that the methods applied in this instance, if employed in any high school, would prove greatly superior to the wasteful "trial and error" methods that now prevail.

Relation of General Level of Intelligence to Success in a Given Subject

In Table IX is shown the correlation between general levels of intelligence and high-school grades in algebra. The algebra grades are recorded under the letters A, B+, B, C, C–, D, and E. The I. Q.'s come under the groups 84-89, 90-94, 95-99, etc.

TABLE IX. CORRELATION BETWEEN I. Q.'S AND GRADES IN ALGEBRA OF 113 HIGH-SCHOOL PUPILS

Algebra Grades	I. Q.'s (Stanford-Binet)										Totals
	80–84	85–89	90–94	95–99	100–104	110–109	110–114	115–119	120–124	125–over	
"A"	.....	.....	.....	2	1	3	0	1	1	3	11
"B+"	.....	.....	.....	.....	.....	.....	1	2	2	5	10
"B"	.....	2	2	3	7	3	7	5	5	2	36
"C"	.....	1	4	5	6	2	5	3	3	3	32
"C–"	.....	.....	.....	1	.....	1	.....	.....	.....	1	3
"D"	.....	1	.....	2	1	1	1	.....	.....	.....	6
"E"	1	3	5	3	.....	1	2	.....	.....	.....	15
Totals....	1	7	11	16	15	11	16	11	11	14	113

Correlation (Pearson): 0.46
Probable error: 0.05

The correlation obtained, 0.46, which is nine times the probable error can be counted as having considerable significance. An examination of the data contained in Table IX will show that twelve of the fifteen failures in algebra, or 80.0 percent of the total number of failures, were earned by pupils with I. Q.'s below 100. There were 35 pupils having I. Q.'s below 100, and 26 of them, or 74.3 percent earned marks below "B," which is the college recommendation grade in California. On the other hand there were 78 pupils with I. Q.'s above 100, and 45 of these, or 63.0 percent, earned marks of "B" or above. An I. Q. of 120 or over denotes very superior intelligence. There are 25 cases with I. Q.'s 120 or over in Table IX. All of these succeeded in earning passing grades in algebra. Only one received a mark as low as "C–."

High-school statistics show that algebra is responsible for more failures of first-year pupils than any other subject. Table IX

suggests that probable success or failure in algebra can be inferred from the general level of intelligence as disclosed by mental tests. It follows that the high percent of failure in algebra could be materially reduced if only those were encouraged to take the subject whose general level of intelligence measured up to average or better.

Relation of Score in a Particular Mental Test to Success in a Given High-School Subject

Test No. 9, in Army Scale, Group Examinations *a* and *b*, is a "word relations" test. It involves a knowledge of word meanings and also the ability to use words intelligently in their proper relations to one another. Table X compares the scores made by 171 first-year pupils of the Palo Alto high school in Test No. 9, with the grades made by the same pupils in English during their first high-school year.

The directions for giving the test are as follows:

In each of the lines below, the first two words have a certain relation. Notice that relation and draw a line under the one word in the parenthesis which has that particular relation to the third word. Begin with No. 1 and mark as many sets as you can before time is called.

TABLE X. CORRELATION BETWEEN GRADES IN ENGLISH AND SCORES IN GROUP INTELLIGENCE TEST NO. 9 OF ARMY SCALE OF 171 HIGH-SCHOOL PUPILS

Marks in First-Year English	Scores in Test No. 9, Examinations *a* and *b*									Totals
	1–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40	
"A"	.....	.....	.....	1	4	1	3	2	.....	11
"B+"	.....	.....	1	1	7	14	10	2	.....	35
"B"	.....	.....	1	5	16	19	13	6	.....	60
"C"	.....	3	9	17	17	8	6	2	.....	62
"D"	.....	.....	.....	.....	1	1	.....	.....	.....	2
"E"	.....	.....	.....	.....	1	.....	.....	.....	.....	1
Totals	.....	3	11	24	46	43	32	12	.....	171

Correlation (Pearson): 0.48
Probable error: 0.04

Sample sets are then given by the examiner to illustrate what is wanted:

sky—blue: grass—(grow, green, cut, dead)
fish—swims: man—(boy, woman, walks, girl)
day—night: white—(red, black, clear, pure)

There were forty sets of words and the time allowed was three minutes. For purposes of tabulation the scores made by the pupils are grouped: 1–4, 5–9, ... 35–39, 40–. The English grades are indicated by the letters A, B+, B, C, C−, D and E.

The correlation, 0.478, is twelve times the probable error and indicates that a good score in the "word relations" test is a fairly good index of ability in first-year high-school English. The marks in English were the final year marks, which represent the minimum of "D's" and "E's," because all conditions and failures had been removed that could be made up. The median score in Test No. 9, was 26, hence scores of 30 or over could be considered superior. There were 44 pupils who made scores of 30 or over, and 36 of these or 82.0 percent made marks in first-year English of "B" or above. Of the 89 who made scores of from 20 to 29 inclusive, 68.5 percent made marks in first-year English of "B" or above. While of the 38 who made scores of from one to nineteen inclusive, only 23.7 percent made marks of "B" or above.

Stated in terms of recommendation for college the above analysis of the data of Table X means that 76.3 percent of the high-school pupils whose ability in word relations is represented by a score of less than 20 fail to secure a college recommendation grade, while only 18.0 percent of those who attain a score of 30 or over in the same test fail to secure such a grade.

These results seem to indicate that a series of tests involving the fundamental traits of mind essential to the successful study of English could be devised. But there are so many mental traits involved in the mastery of the subject of English that a series of tests bringing into play all those traits would undoubtedly be found to be a good test of general intelligence as well as a test of specific ability in English.

Summary and Conclusions

1. The results of an experiment in educational guidance, in which all the members of an VIIIA class about to enter high

school were given mental tests and advised with reference to their first-year high-school work, proved very satisfactory. Compared with an unguided group it was found that while 31 percent of the unguided group failed in one subject, and 10 percent failed in two or more subjects during their first high-school year, only 18 percent of the guided group failed in one subject and none of them failed in two subjects. The mental tests aided in the discovery of the pupil's general level of intelligence, made possible the giving of sound educational advice at the time when it would do the most good, and thus tended to reduce the percent of failure and elimination. The methods employed can be adapted to the needs of any high school.

2. The general level of intelligence is shown to have real significance as a means of predicting success in a particular subject, such as algebra. In Table IX it was shown that 100 percent of those having I. Q.'s of 120 or over passed in their algebra, while 40 percent of those with I. Q.'s below 100 either failed or were conditioned in algebra, and only 26 percent of the members of this group earned college recommendation grades. The general level of intelligence could be relied upon as a means of selecting those who would be most likely to succeed in algebra and kindred subjects.

3. Success in a particular test of a series may be a fairly reliable index of success in a high-school subject involving the mental traits supposed to be measured by the test in question. High scores in the "word-relations" test of the Army Scale, Examinations *a* and *b*, correspond generally to high marks in first-year high-school English, while scores below twenty in the same test correspond generally to low marks in the same subject.

4. Mental tests for purposes of prognosis in individual high-school subjects such as algebra, English, etc., could no doubt be devised. But the mastery of any high-school subject involves such a complex of mental traits that any test which proves to be a good test of ability to succeed in one subject is quite apt to be found a good test of general mental ability. It has already been shown that a high-school pupil having a high level of intelligence will probably succeed in all of his subjects, and conversely that a pupil having a low level of intelligence is apt to fail in most of his high-school subjects. The best way, therefore, in which to arrive

at an estimate of a given pupil's probable success in a specific high-school subject is to discover the general level of his intelligence. It follows that standardized mental tests may render invaluable service in the educational guidance of high-school pupils. Particularly will this be found to be true if the results of the mental test are interpreted in the light of other significant data, such as school marks made in previous grades, teachers' estimates of ability, and educational and vocational plans.

CHAPTER IV

THE USE OF PSYCHOLOGICAL TESTS IN THE VOCATIONAL GUIDANCE OF HIGH-SCHOOL PUPILS

The use of psychological tests as a basis for the prediction of probable school success, and in the educational guidance of high-school pupils has been discussed in Chapters II and III. The use of such tests in the vocational guidance of high-school pupils will be discussed in this chapter.

The Employment Manager and the Vocational Counselor

The application of psychological tests to the selection of men for particular jobs is well along in the experimental stage.[1] The employment manager has demonstrated the value of such tests when used in the selection of employees. If the tests are carefully devised to discover whether the applicants have certain essential mental qualifications for the kind of work they will be called upon to perform, and if final selection is made from the few who make high scores in the tests, the results are likely to be satisfactory to the employer. When in addition to specific mental tests, appropriate trade or performance tests are given, the employment manager or personnel expert can select from the highest 25 percent of applicants with reasonable assurance that they will make good at the tasks assigned to them. These tests tend effectively to sift out the undesirables, to reduce the amount of labor turnover, and to secure for the employer a higher grade of employees.

The person who selects men for a particular occupation needs only to know the qualifications for success in that occupation. He can plan his tests with a view to eliminating all those who do not measure up to the established standard. If only five out of one hundred applicants are selected and they all prove to be adapted to their work the tests by which they were selected are counted as satisfactory. The ninety-five rejected applicants do not concern the employment manager.

[1] Link, H. C. *Employment psychology.* New York: Macmillan Co., 1919.

The vocational counselor, however, has to think of the ninety-five as well as the five. His field is a broad one. He is called upon to advise people possessing every variety of fitness to enter every possible kind of occupation. It would be manifestly impossible for the vocational counselor to give adequate trade or psychological tests corresponding to the infinite variety of occupations open to American youths.

It is true that he must avail himself of every possible scientific aid in arriving at his conclusions. His preparation will necessarily include a wide knowledge of occupations, and special training in the discovery of occupational aptitudes. But he should never persuade himself or lead others to believe that he is able to chart unerringly their abilities and give them an absolute vocational classification.[2] The successful counselor will understand at the outset that he is a guide and not a dictator, and that he is dealing with probabilities and not with certainties.[2]

Occupational Levels of Intelligence

Among the factors which the counselor must take into account in estimating the probability of a person's success in an occupation, the intelligence level is one of the most important. If we accept Stern's definition of intelligence as a working basis for the discussion of the subject, there can be no question of the vital connection between intelligence and vocational success. Stern says:[3] "Intelligence is a general capacity of an individual consciously to adjust his thinking to new requirements: it is general mental adaptability to new problems and conditions of life." Given a high degree "of mental adaptability to new problems and conditions of life" coupled with energy, persistence, and reliability, it would be reasonable to assume that one's range of possible vocational success would be wide. Conversely given a low level of intelligence, even though the other qualities mentioned are present, one's range of possible vocational success would be greatly restricted.

[2] Kitson, H. D., "Vocational guidance and the theory of probability," *School Review*, 28:143–50, February, 1920.

[3] Stern, William. *The psychological methods of testing intelligence.* Baltimore, Warwick & York, 1914, p. 3.

We have already gone far enough in the development of intelligence tests to justify the statement that individual levels of intelligence can be discovered with approximate accuracy. The next step, so far as vocational guidance is concerned, is to discover whether or not there are occupational intelligence levels, i.e. levels of intelligence more or less characteristic of the workers in a given occupation. That there are discoverable differences in the intelligence levels of workers in the various occupations is suggested by the findings of the Division of Psychology, Sanitary Corps, United States Army.[4]

Table XI is derived from the chart found on page 23 of the pamphlet, *Army Mental Tests*. The median ratings of this chart are changed from the letters "A," "B," etc. to the raw scores on the Alpha Army Scale (which range from 0 to 212). For each of the 43 occupations selected from the 72 shown on the chart, the median score is given, as well as the range of the middle 50 percent of the scores. The top line of the table would then read: laborers, median score, 35; range of scores made by the middle 50 percent, 21-63. It should then be understood that 25 percent of the laborers scored less than 21 points, while the top 25 percent scored over 63 points out of a possible 212 points. The chart was made up from the returns of approximately 36,500 men, and the data were taken from the soldiers' qualification cards.

Figure 3 illustrates graphically the spread of the middle 50 percent of the scores on Army Alpha by occupational groups. There is considerable overlapping. The unskilled, semi-skilled, and skilled labor groups differ but little as to the beginning of the middle 50 percent of scores (21, 23, and 26 respectively). But there is a distinct difference in the upper limits, which are 63, 70, and 95 respectively. The beginning of the middle 50 percent of the business and clerical group is nearly as high as the upper limit for the unskilled labor group, and the beginning of the middle 50 percent of the professional group is higher than the upper limit of the skilled labor group.

If the scores of the entire number of men examined by the Division of Psychology, Sanitary Corps, of the United States Army, could be grouped by occupations the final results of compilation would probably show some deviations from the medians

[4] *Army mental tests, methods, typical results, and practical applications.* Washington: Government Printing Office, November, 1918.

TABLE XI. OCCUPATIONAL INTELLIGENCE LEVELS, BASED ON ARMY PSYCHOLOGICAL TESTS OF 36,500 MEN ALPHA SCALE

Occupations	Median Score	Range of Middle 50 Percent
LABORERS (UNSKILLED)	35	21 to 63
SEMI-SKILLED LABOR		
Cobblers	39	23 to 67
Teamsters	41	23 to 68
Farm workers	42	24 to 70
Barbers	43	22 to 70
Horse-shoers	44	25 to 70
SKILLED LABOR		
R. R. shop-mechanics	45	26 to 83
Bricklayers	48	23 to 81
Cooks	49	28 to 79
Bakers	53	35 to 83
Painters	53	31 to 79
Blacksmiths	54	29 to 83
Bridge-carpenters	55	27 to 84
General carpenters	57	33 to 85
Butchers	58	33 to 85
Locomotive enginemen	59	33 to 82
Machinists	61	33 to 86
R. R. conductors	62	40 to 84
Plumbers	62	38 to 87
Tool-makers	63	41 to 88
Auto-repairmen	63	41 to 89
Chauffeurs	63	38 to 90
Tool-room-experts	64	43 to 88
Policemen-detectives	64	44 to 89
Auto-assemblers	65	44 to 97
Ship-carpenters	66	49 to 95
BUSINESS AND CLERICAL		
Telephone operators	70	58 to 99
Concrete const'n foremen	75	48 to 116
Photographer	77	52 to 104
General electrician	82	58 to 110
Telegraphers	84	59 to 107
R. R. clerks	92	66 to 116
General clerks	96	74 to 123
Mechanical engineers	98	63 to 133
Bookkeepers	99	78 to 126
Dental officers	106	84 to 130
Mechanical draughtsmen	112	79 to 134
Stenographers	115	93 to 142
Accountants	117	101 to 145
PROFESSIONAL		
Civil engineers	125	98 to 147
Medical officers	130	101 to 165
Army chaplains	150	109 to 173
Engineer officers	157	134 to 184

Approximate occupational intelligence levels:

1. Unskilled labor	Median	35,	Middle	50%	21	to	63
2. Semi-skilled	"	42,	"	"	23	to	70
3. Skilled labor	"	61,	"	"	26	to	95
4. Business and clerical	"	96,	"	"	58	to	145
5. Professional	"	140,	"	"	98	to	184

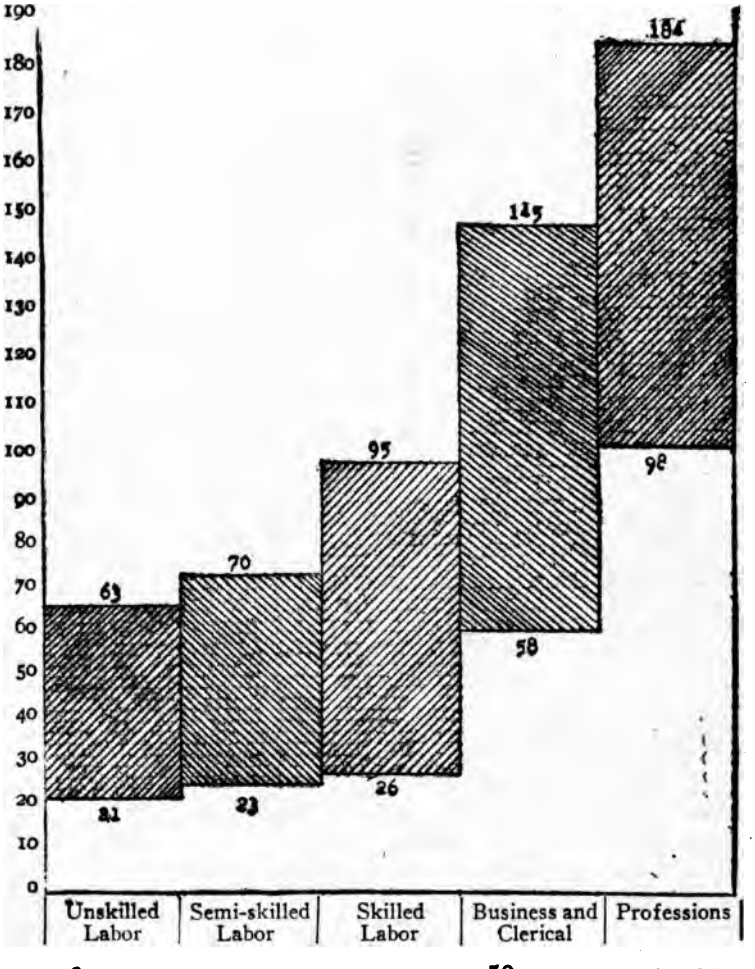

FIGURE 3. SHOWING SPREAD OF MIDDLE 50 PERCENT OF CASES, TABLE XI, BY OCCUPATIONS

TABLE XII. VOCATIONAL AMBITIONS OF 930 HIGH-SCHOOL PUPILS DISTRIBUTED ACCORDING TO INTELLIGENCE RATINGS ON ARMY SCALE ALPHA AND GROUP EXAMINATIONS *a* AND *b*

Letter rating	C—	C		C+		B		A		
Alpha.....	25–44	45–59	60–74	75–89	90–104	105–119	120–134	135–212	Total	
a and *b*.....	25–49	50–67	68–84	85–99	100–119	120–137	138–154	155–287		
Choice of Occupation										
AGRICULTURE										
Agriculture.....	.....	2	1	5	4	7	10	12	41	
Floriculture.....	.....	.....	.....	.....	1	.....	.....	.....	1	
Forestry.....	.....	.....	1	.....	.....	1	.....	2	4	46
MECHANICAL AND INDUSTRIAL										
Auto-mechanic...	.....	.....	.....	.....	4	.....	.....	.....	4	
Dressmaker.....	.....	.....	.....	.....	.....	2	.....	.....	2	
Draughtsman.....	.....	.....	2	5	.....	3	8	3	21	
Electrician.....	.....	.....	.....	.....	.....	1	.....	.....	1	
Contractor.....	.....	.....	.....	.....	1	.....	.....	.....	1	
Milliner.....	.....	.....	.....	.....	1	.....	.....	.....	1	
Printer.....	.....	.....	.....	.....	.....	1	1	.....	2	
Aviator.....	.....	.....	.....	.....	1	.....	1	.....	2	34
BUSINESS AND CLERICAL										
Banker.....	.....	.....	.....	1	.....	.....	.....	1	2	
Bookkeeper	.....	3	5	10	22	9	7	6	62	
Business manager.	.....	1	2	6	5	3	1	5	23	
Civil Service.....	.....	.....	.....	.....	.....	.....	1	.....	1	
Clerk (sales).....	.....	.....	1	1	.....	1	.....	.....	3	
Manufacturer....	.....	.....	.....	.....	1	1	.....	.....	2	
Real estate.....	.....	.....	.....	1	.....	1	.....	1	3	
Salesman (Tr)....	.....	.....	.....	.....	2	1	1	.....	4	
Stenographer.....	2	2	11	24	41	38	33	25	176	276
UNCLASSIFIED										
Actress.....	.....	.....	.....	2	1	1	.....	.....	4	
Army and Navy..	.....	.....	.....	.....	3	3	2	6	14	
Artistic career....	.....	.....	2	2	10	5	6	3	28	
Dancer.....	.....	.....	.....	.....	.....	.....	1	.....	1	
Dog Fancier.....	.....	.....	.....	.....	1	.....	.....	.....	1	
Home-maker.....	.....	.....	1	.....	1	1	1	1	5	
Nurse.....	.....	.....	4	7	10	11	8	6	46	
Sea-captain.....	.....	.....	.....	.....	1	.....	.....	.....	1	
Social Service.....	.....	.....	.....	.....	.....	1	.....	1	2	
Writer.....	.....	.....	.....	.....	.....	.....	1	1	2	104
PROFESSIONAL										
Architect.....	.....	.....	.....	.....	.....	3	.....	.....	3	
Bacteriologist....	.....	.....	.....	.....	.....	.....	1	1	2	
Chemist.....	.....	.....	.....	1	.....	3	3	7	14	
Dentist.....	.....	1	.....	2	3	1	2	2	11	
Druggist.....	.....	.....	.....	.....	.....	2	.....	3	5	
Engineering.....	.....	.....	2	12	20	30	32	44	140	
Journalism.....	.....	.....	.....	.....	2	3	.....	5	10	
Law.....	.....	.....	.....	.....	2	2	9	7	20	
Librarian.....	.....	.....	.....	.....	.....	1	2	2	5	
Ministry.....	.....	.....	.....	.....	.....	.....	1	.....	1	
Physician.....	.....	.....	.....	1	4	11	10	10	36	
Teaching.....	.....	.....	8	23	44	68	47	33	223	470
Totals.....	2	9	40	103	185	215	189	187	930	

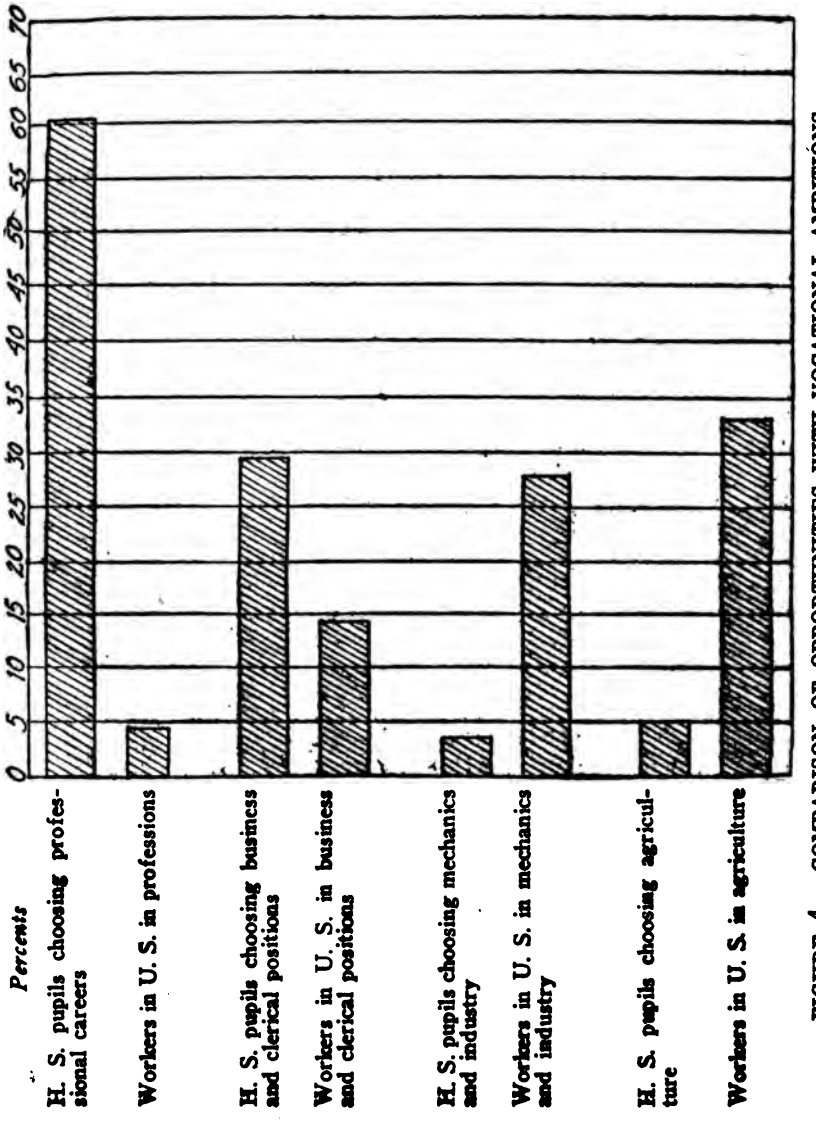

FIGURE 4. COMPARISON OF OPPORTUNITIES WITH VOCATIONAL AMBITIONS

and middle 50 percents given in Table XI. But the general tendencies therein indicated would no doubt be confirmed. There would be found more or less clearly defined levels of intelligence in the various occupations, corresponding roughly to the amount of intelligence necessary to succeed in them. There would be much overlapping and within each occupation a wide range of intelligence would be found. But in the occupational groups above unskilled labor one would expect to find critical scores[5] or points below which occupational success could not be expected.[6] In the professional group for example, one would expect to find the greatest number of occupational failures among the lowest 25 percent, i. e., among those who made scores ranging from 0 to 98.

Application to Guidance of High-School Pupils

How a knowledge of individual and occupational intelligence levels may be utilized in the vocational guidance of high-school pupils can be illustrated by the data presented in Table XII. In this table 930 pupils in eight high schools are distributed according to vocational ambition and scores made on Army Scale Alpha and Examinations *a* and *b*. The different occupational choices have been divided into five groups: agriculture, mechanical and industrial, business and clerical, unclassified,[7] and professional. The professional group covers 50.5 percent of the choices, 470 cases; unclassified, 11.2 percent, 104 cases; business and clerical, 29.7 percent, 276 cases; mechanical and industrial, 3.6 percent, 34 cases; and agricultural, 5.0 percent, 46 cases.

The need for vocational guidance of high-school pupils is brought out very clearly by the way in which the choices are concentrated in the professional, semi-professional (i. e. unclassified), and business and clerical divisions of Table XII. These include 31 different occupations, popularly known as "white collar jobs," and comprise 91.2 percent of the 930 choices. Agricultural, mechanical and industrial occupations include 11 different employments, and 8.8 percent of the choices. See Figure 4.

[5] Thurstone, L. L. "Mental tests for college entrance," *Journal of Educational Psychology*, 10:129–41, March, 1919.

[6] Cowdery, K. M. "A statistical study of intelligence as a factor in vocational success," *Journal of Delinquency*, 4:227, November, 1919.

[7] Most of the occupations belonging to this group are called "professional" by the United States Census Bureau.

Vocational opportunities, as shown by the United States census reports,[8] are just about the reverse of the distribution of high-school pupils' occupational choices. Agriculture and the mechanical and industrial arts engage the energies of 61.1 percent of the gainful workers in the United States, and only 8.8 percent of the high-school pupils had ambitions looking toward these fields. Business and clerical employments enlist only 14.1 percent of the gainful workers of the country; and yet 29.7 percent of the high-school pupils plan to enter these fields of effort. In the United States census reports practically all of the occupations designated in Table XII as unclassified, are included under the caption "professional service." In spite of this liberal interpretation of the term "professional" only 4.4 percent of the gainful workers are found to be engaged in professional service in this country. Nevertheless the professional and unclassified divisions of Table XII include 574 choices, or 61.7 percent of the total number.

Although it is a fact that the high school represents a rather highly selected group of young people from whose ranks the clerical, business, and professional occupations are very largely recruited, it is apparent that by no means 91.2 percent of high-school pupils will find their way into these occupational fields. Furthermore for their own best good and the best good of the nation a great many of them should be directed toward the agricultural, mechanical, and industrial fields.

The question may be raised as to the use that a vocational counselor might make of facts regarding the intelligence of high-school pupils such as are shown in Table XII. Assuming that occupational levels approximating those found in Table I have been established, the counselor could proceed on the theory that those falling within the lowest quarter of intelligence ratings, i. e. who make scores lower than the beginning score for the middle 50 percent of a given occupation, would probably have small chances of success as workers in that occupation.

Take the professional group. The intelligence-score limits of the middle 50 percent as shown in Table XI are from 98 to 184 (Alpha). There are fifty cases in the professional group, Table

[8] *Thirteenth census of the United States, 1910. Volume 4: population: occupation statistics.* Washington: Government Printing Office, 1914, p. 40.

XII, who made an intelligence score of less than 90 points on the Alpha scale. The counselor could safely consider the cases falling in this quarter of the professional group as doubtful. If teachers' estimates of intelligence and school marks confirmed the findings of the mental tests, he would be justified in making an effort to direct the thoughts of those boys and girls toward some other life career.

Specific occupations treated in the manner just outlined for the entire professional group would yield the following percents of doubtful cases: draughtsmen, 23.8 percent; bookkeepers, 21 percent; stenographers 22.1 percent; dentists, 18.1 percent; engineers, 24.3 percent; lawyers, 15 percent; doctors, 13.9 percent; and teachers, 33.6 percent.

If by making use of intelligence ratings of individual pupils in connection with the intelligence levels of the occupations which they are ambitious to enter the vocational counselor can give them more accurate advice as to the life career in which they are most apt to succeed he should by all means make use of such ratings. But it will probably be pointed out that intelligence ratings are not in themselves sufficiently reliable to justify their use in vocational guidance. To this objection it may be replied that the high-school counselor has at hand means of verifying the results of the mental tests. He can secure the estimates of teachers and others who know the pupils and he can secure the record of their success in school tasks. Agreement between teachers' estimates of intelligence and mental tests, or agreement between school marks and mental tests would greatly strengthen the presumption that the tests had succeeded in discovering the pupil's mental level.

Discovery of Agreement between Mental Tests, School Marks, and Vocational Ambition

The cases of the high-school pupils, whose mental ratings and vocational ambitions are set forth in Table XII, are redistributed in Table XIII in accordance with standing in school subjects, intelligence tests, and rank of vocational ambition. For the purposes of the three-way distribution, vocational ambitions are ranked as follows: Rank I: higher professional and executive

TABLE XIII. DISTRIBUTION OF 930 HIGH-SCHOOL PUPILS ACCORDING TO INTELLIGENCE, SCHOOL MARKS, SEX, AND VOCATIONAL CHOICE

Rank of Vocational Ambition	Marks Below Average						Marks Average						Marks Above Average						10 Totals		
	1 I. Q. Below Average		2 I. Q. Average		3 I. Q. Above Average		4 I. Q. Below Average		5 I. Q. Average		6 I. Q. Above Average		7 I. Q. Below Average		8 I. Q. Average		9 I. Q. Above Average				
	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	All
I.....	7	0	13	4	17	3	7	4	18	3	15	3	4	8	32	25	76	36	189	86	275
II.....	7	11	29	18	4	7	4	14	10	34	16	4	5	14	27	84	38	51	140	237	377
III.....	6	20	14	26	5	0	3	11	15	30	13	4	7	19	18	53	9	25	90	188	278
IV.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V.....	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total.....	20	31	56	48	26	10	14	29	43	67	44	11	16	41	77	162	123	112	419	511	930

positions; Rank II: business, semi-professional, higher clerical positions; Rank III: general clerical, skilled labor etc.; Rank IV: semi-skilled labor; Rank V: unskilled labor.

Mental age equivalents for the Army Scale ratings were worked out by Dr. Samuel C. Kohs and the writer, and from them intelligence quotients (I. Q.'s) were computed. The mental level of a child is more nearly represented by the I. Q. than by the raw scores on an absolute point scale because the latter take no account of the chronological age.

Sex differences in rank of vocational ambition are indicated in column 10. There are 189 boys, or 45.1 percent of the total number of boys, but only 86 girls, or 16.8 percent of the girls, who chose vocations of the first rank. The vocational ambitions of 33.4 percent of the boys and 46.3 percent of the girls are represented by Rank II, and those of 21.5 percent of the boys and 36.9 percent of the girls by Rank III. There were none of the 930 who chose vocations of less than Rank III. The most numerous choices of the boys were for the engineering profession and of the girls for stenography and teaching.

How those whose ambitions come in the different ranks would probably measure up in mental ability to the demands of the occupations chosen can be estimated by reference to the nine possible combinations of I. Q. and school marks. Entries in column 1 show those who have I. Q.'s and school marks both below average. There are 51 pupils in this group. Seven of them have chosen occupations of Rank I, and 18 of Rank II. Since school marks confirm indications of mental tests as to low mental level in these cases the success of these pupils in occupations of Ranks I or II would be open to question.

In column 7 there are 57 cases, 16 boys and 41 girls, having marks above average and I. Q.'s below average. Here is an indication that the tests did not register the full ability of the pupils, or that they possess qualities of persistence and other attributes tending to supplement intelligence as factors in successful school work.

Columns 2 and 3 indicate that there are many pupils whose intelligence is average or above average but who do poor school work. Teachers are apt to rate such pupils low in intelligence. The mental tests give the counselor an insight into their true

ability and enable him to employ methods of waking them up through the discovery of the right life-career motive.

The cases entered in columns 6 or 9 where the I. Q.'s are above average and school success is average or above average can be considered as satisfactory, so far as intelligence is concerned, for the occupations chosen. However, the counselor can be of great service to the pupils in these groups through his ability to give information as to the demand for workers, the opportunities for advancement, the qualifications as to health, temperament, training, etc., expected of those who enter the occupations selected for consideration.

There is no purpose here to suggest that a counselor should always advise those who have superior ability to enter high ranking occupations. If a bright boy or girl would be more contented in an occupation ranking low on the rating scale there is no occasion to urge them to select another simply because it ranks higher in popular estimation. There is room for superior intelligence in every occupation, and it would be well for the country if young people of superior ability were encouraged to follow agricultural, mechanical, and industrial pursuits, in order that they might become leaders therein. The professions are overcrowded, but there is always room for young people with ideas and energy in the food producing and industrially creative occupations.

Summary and Conclusions

1. The use of psychological and trade tests in the selection of employees can be more easily shown to be effective, than can the use of such tests in vocational guidance. The employment manager can "play safe" by rejecting all but the most promising applicants, while the vocational counselor must needs endeavor to give sound advice to all comers.

2. Minute charting of abilities by means of psychological and trade tests is not practicable at the present time for the public school vocational counselor. There are far too many different occupations and the specific abilities of individual pupils are much too various to permit of accurate "pigeonholing" according to manual, conceptual, and other types. Likewise a given combination of abilities might mean successful participation in any one of a wide range of occupations.

3. The discovery of the levels of intelligence of individuals and of occupational groups may prove to be of great assistance to the high-school counselor. The data on army mental tests, arranged in Table XI, indicate that there are rather definitely marked occupational levels of intelligence. The norms already suggested would probably be confirmed by a compilation of all available data.

4. Application of the Army Intelligence Scale to 930 high-school pupils and the distribution of the cases according to intelligence rating and vocational ambitions is shown in Table XII. Illustration is also given of the way in which this knowledge might be applied to the vocational guidance of the group tested.

5. Need of vocational guidance of high-school pupils is shown by the fact that the concentration of choices in the professional, business, and clerical occupations is out of all proportion to the opportunities in those lines as shown by the United States census. The demands for workers in agricultural, industrial, and mechanical pursuits should be emphasized by the counselor.

6. The need for supplementary information to verify the findings of the intelligence tests is shown in Table XIII. The 930 cases are distributed according to sex, school marks, vocational ambition, and intelligence. Where intelligence rating and school marks agree the presumption is that the intelligence level was approximated by the mental test. Where they do not agree it is a warning to make further inquiry into the matter.

7. The employment of psychological tests as an aid in vocational guidance is in the early experimental stage, but sufficient progress has been made to justify their use in a negative way, i.e., as a means of discovering to the counselor the kinds of occupations that a given high-school pupil would probably better avoid. They are useful also as a means of satisfying a counselor that a given pupil has the mental ability to engage in the occupation which he has chosen, providing other necessary factors conditioning success are present. In any case the counselor will do well to remember that he is dealing with probabilities and not with certainties. The mental tests, if conservatively employed, will increase the probability that the counselor will give really helpful advice.

CHAPTER V

PSYCHOLOGICAL TESTS AND COLLEGE ENTRANCE

Since the announcement by Columbia University that psychological tests had been adopted as an optional means of entrance to Columbia College for boys suitably recommended, there has been widespread experimentation with that method of testing fitness for college. Other universities, notably the Univeristy of Pennsylvania, University of Chicago, the University of California, and Leland Stanford University now employ psychological tests as one of the conditions precedent to the admission of students of maturity who have not had full high-school preparation. A high score in a psychological examination is accepted as evidence of ability to undertake university work with profit.

In pursuance of this policy toward "special" students a young man, a disabled soldier and trainee of the Federal Board for Vocational Education, who had never gone beyond the fifth grade, was admitted to Stanford University on the strength of his high rating in a psychological examination. He undertook fifteen hours of regular work, and at the end of his first quarter had earned twelve and a half hours of "B" and two and a half hours of "C" grades. This man without any formal college preparation is showing his ability to undertake and to profit by regular university courses.

This case and other similar ones that have come to light since the policy was adopted of giving men a chance on the basis of superior ability as shown by psychological examinations, suggests the idea that every institution of higher learning should reserve at least 2 or 3 percent of its new registrations for men and women of this type.

The standardization of mental tests that could be used by institutions adopting such a policy has been progressing rapidly within the past three years. Dr. E. L. Thorndike of Columbia University has developed and is perfecting his "Intelligence Examination for High School Graduates";[1] and Dr. L. M. Terman of Stanford University has just published his mental test for high-

[1] See Appendix, page 70.

school pupils.[2] The Otis Absolute Point Scale[3] and the Army Alpha Scale[4] have already been widely used for testing large groups of college and university students.

Before abandoning the traditional entrance requirements college and university authorities will want to be assured that, as a means of predicting possible success in college work, psychological tests have at least equal value with the record of the four years of preparatory work now required. The writer's contribution to this discussion will consist of the presentation of the data regarding 93 young people who were given the Alpha Army Test in 1917-1918 while still in high school and who entered Stanford University after graduation from high school.

In Table XIV the cases of these students are arranged in quartiles according to rank in intelligence quotients.[5] Column 1 gives this rank order; column 2, the intelligence quotients; column 3, the high-school scholarship rating. (All high-school grades were given numerical values—1 for "A," 2 for "B," etc.—and averaged.) Columns 4 to 9 inclusive indicate the quarter hours of university marks earned by each student while at Stanford. Column 10 shows the total number of hours taken; column 11, the number of honor points; and column 12, the scholarship rating in university work.[6] The period of university work covered was that of the first three quarters (or that of the freshman year).

Relation of Rank in Intelligence to Scholarship in College

The summary of the 23 cases falling in the first quarter indicates that the median intelligence quotient was 127; that the median high-school scholarship was 1.9 (or a trifle better than B); and that as to ratings at the university 47 percent of the A's

[2] See Appendix, page 69.

[3] See Appendix, page 69.

[4] See Appendix, page 69.

[5] All I. Q.'s are computed on the basis of the Kohs-Proctor mental age norms for Alpha test. See Appendix, page 67.

[6] This scholarship rating is secured by dividing the total number of registered hours into the honor points earned. Three honor points are given for a grade of "A"; two for a grade of "B"; one for a "C"; none for "D" or "E." The highest possible rating (all "A's") would be 3.00; the lowest (all "D's" or "E's") would be 0.0. A rating of "1.0" is average.

TABLE XIV. RELATION BETWEEN RANK ORDER IN PSYCHOLOGICAL EXAMINATION AND SCHOLARSHIP IN HIGH SCHOOL AND UNIVERSITY (WORK OF THE FIRST THREE QUARTERS)

Rank According to I. Q.	I. Q.	H. S. Scholarship[a]	Number of Hours Indicated Grades at University						Total Hours	Honor Points	University Scholarship Rating[b]
			A	B	C	D	Cond.	Fail.			
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
1	138	1.7	5	29	11	3	0	0	48	84	1.75
2	136	2.2	23	8	9	0	0	0	40	94	2.35
3	135	1.8	5	30	10	0	0	0	45	85	1.89
4	134	2.2	8	15	12	4	0	0	39	66	1.69
5	133	1.8	0	0	29	6	0	3	38	29	0.76
6	132	1.6	3	13	10	15	0	0	41	45	1.10
7	131	1.0	31	19	0	0	0	0	50	131	2.262
8	130	1.3	20	10	0	0	0	0	30	80	2.66
9	129	1.2	33	13	0	0	0	0	46	125	2.71
10	128	2.4	5	19	15	5	0	0	44	68	1.54
11	128	2.2	5	4	16	5	5	2	37	39	1.05
12	127	1.9	15	33	0	0	0	0	48	111	2.31
13	127	1.7	11	21	14	0	0	0	46	89	1.93
14	126	1.3	25	11	8	0	0	0	44	105	2.40
15	126	2.9	1	25	17	0	3	0	46	70	1.52
16	125	2.6	0	9	26	0	7	4	46	44	0.95
17	125	2.5	7	23	8	1	5	0	44	75	1.70
18	125	1.9	6	8	17	0	0	0	31	51	1.66
19	125	2.8	5	34	5	0	0	0	44	88	2.00
20	124	2.9	1	20	16	5	0	0	42	59	1.40
21	123	1.4	14	16	7	8	0	0	45	81	2.80
22	122	1.5	15	18	11	0	0	0	44	92	2.09
23	122	2.6	24	22	3	0	0	0	49	119	2.43
Totals, First Quartile			262	400	244	52	20	9	987	1830	1.89[c]
24	122	1.8	5	11	19	11	0	0	46	56	1.22
25	121	1.3	17	6	2	0	0	0	25	65	2.60
26	121	2.2	14	22	8	0	0	0	44	99	2.25
27	120	1.1	28	14	0	0	0	0	42	112	2.57
28	120	1.1	6	29	5	5	0	0	45	81	1.80
29	120	2.8	2	23	17	0	5	0	47	69	1.47
30	120	2.7	0	15	20	0	5	5	45	50	1.10
31	119	1.7	5	8	14	8	5	5	45	45	1.00
32	118	2.4	0	15	19	4	3	1	42	49	1.16
33	118	1.0	8	35	4	0	0	0	47	98	2.08

TABLE XIV (*Continued*)

Rank According to I. Q.	I. Q.	H. S. Scholarship[a]	Number of Hours Indicated Grades at University						Total Hours	Honor Points	University Scholarship Rating[b]
			A	B	C	D	Cond.	Fail.			
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
34	118	1.5	12	25	0	0	0	0	37	86	2.32
35	117	2.4	8	8	29	1	0	0	46	69	1.50
36	117	2.0	0	25	13	5	0	0	43	63	1.46
37	116	2.1	0	18	22	0	0	0	40	58	1.45
38	116	2.1	0	28	11	5	0	0	44	67	1.52
39	116	2.5	5	0	0	0	5	5	15	15	1.00
40	116	1.7	10	21	8	3	0	0	42	80	1.90
41	116	2.4	3	12	18	10	0	4	47	51	1.08
42	115	1.9	20	17	7	0	0	0	44	101	2.29
43	115	2.0	0	30	11	0	0	0	41	71	1.77
44	115	3.0	0	24	12	10	0	0	46	60	1.30
45	115	2.3	5	26	14	0	0	0	45	81	1.80
46	113	2.2	17	21	11	0	0	0	49	104	2.12
Totals, Second Quartile			165	433	264	62	23	20	967	1630	1.52[c]
47(*Median*)[d]	113	2.7	10	7	23	8	0	0	48	67	1.40
48	113	3.0	0	6	15	0	0	8	29	27	0.93
49	112	2.1	6	9	24	4	0	0	43	60	1.40
50	112	2.0	0	6	8	10	8	12	44	20	0.45
51	112	2.6	0	19	16	5	0	5	45	54	1.20
52	111	3.2	9	18	9	10	0	0	46	72	1.56
53	111	3.0	0	8	27	8	0	0	43	43	1.00
54	111	3.0	0	0	2	0	0	9	11	2	0.18
55	110	1.8	10	28	5	0	0	0	43	91	2.11
56	110	2.8	7	11	13	10	7	0	48	56	1.16
57	110	2.4	3	24	19	4	0	0	50	76	1.53
58	110	1.0	16	18	8	0	0	0	42	92	2.20
59	110	2.3	5	13	29	0	0	0	47	70	1.49
60	110	3.0	0	9	22	12	0	3	46	40	0.87
61	110	2.0	7	18	10	0	0	0	35	67	1.91
62	110	3.1	0	9	19	5	8	0	41	37	0.81
63	109	2.2	0	13	10	7	0	0	30	36	1.20
64	109	3.3	2	0	10	0	4	0	16	16	1.00
65	109	3.0	0	10	1	8	5	9	33	21	0.63
66	108	3.3	3	4	16	10	0	0	33	33	1.00
67	108	3.0	0	15	32	3	0	0	50	62	1.24
68	107	3.0	0	15	8	10	3	0	36	38	1.06
69	107	3.0	0	23	10	10	0	0	43	56	1.30
70	107	2.7	0	10	35	0	0	0	45	55	1.22
Totals, Third Quartile			68	286	348	116	35	46	899	1124	1.20[c]

TABLE XIV (*Continued*)

Rank According to I. Q.	I. Q.	I. Q. Scholarship	Number of Hours Indicated Grades at University						Total Hours	Honor Points	University Scholarship Rating[b]
			A	B	C	D	Cond.	Fail.			
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
71	106	2.2	0	5	0	0	13	0	18	10	0.55
72	106	2.6	0	0	38	3	0	4	45	38	0.84
73	106	3.0	0	0	5	11	2	3	21	5	0.24
74	106	2.9	0	9	29	5	0	0	43	47	1.09
75	106	2.2	9	17	14	0	0	3	43	75	1.74
76	106	2.5	10	15	9	7	0	0	41	69	1.70
77	105	2.2	13	31	5	0	0	0	49	106	2.16
78	105	2.7	0	5	34	5	0	0	44	44	1.00
79	105	3.0	0	2	16	5	5	17	45	20	0.44
80	105	3.3	10	26	7	0	0	0	43	89	2.07
81	105	3.3	0	0	6	8	0	0	14	6	0.43
82	104	2.6	0	10	5	8	0	7	30	25	0.83
83	104	3.0	0	18	13	9	0	4	44	49	1.11
84	103	3.0	3	24	19	0	0	0	46	76	1.65
85	102	4.0	0	6	17	5	0	3	31	29	0.93
86	100	1.0	0	12	26	5	0	0	43	50	1.16
87	100	4.0	0	3	19	14	1	5	42	25	0.59
88	100	1.0	7	25	4	0	0	0	36	75	2.09
89	96	2.8	0	13	30	0	0	3	46	56	1.22
90	95	3.6	0	3	18	9	0	0	30	24	0.80
91	92	2.9	6	10	16	8	5	0	45	54	1.20
92	90	4.0	0	10	16	15	0	5	46	36	0.78
93	82	2.7	0	3	0	0	0	10	13	6	0.46
Totals, Fourth Quartile			58	247	346	117	26	64	858	1014	1.18[c]
Grand Totals			563	1373	1225	355	104	139	3759	5665	

[a] 1.0 is the highest and 4.0 the lowest high-school scholarship rating.
[b] 3.0 is the highest and 0 the lowest university scholarship rating.
[c] Median scholarship rating for quartile.
[d] No. 47 is the median student according to intelligence quotients.

but only 7 percent of the failures, belonging to the entire 93 students, were allotted to the first quarter. In addition to this, 33 percent of the honor points came to the students in this quarter, and their average scholarship rating in university courses was 1.89.

The corresponding figures for the fourth quarter contrast with those of the first quarter. For example, only 10 percent of

TABLE XV. SUMMARY OF TABLE XIV BY QUARTILES

Quartile	Median I. Q.	Median H. S. Scholarship	Percent of Total Number of Each Grade						Percent of Total Hours	Percent of Honor Points	Median University Scholarship
			A	B	C	D	Cond.	Fail.			
I.....	127	1.9	47	29	20	15	19	7	26	33	1.89
II.....	117	2.1	29	32	22	17	22	14	26	29	1.52
III.....	110	3.0	12	21	28	33	34	33	24	20	1.20
IV.....	104	2.8	10	17	28	33	25	46	22	17	1.00
I and II.....	122	2.0	76	61	42	32	41	21	52	62	1.75
III and IV.....	107	2.9	22	38	56	66	59	79	46	37	1.10
Median case[a]....	113	2.7	2	1	2	2	0	0	2	1	1.40

[a] This is student No. 47 of Table XIV. Entries on this line are the individual measures for that student.

the A's awarded to the 93 students were earned by the 23 students whose intelligence quotients were in the lowest quarter. On the other hand, 46 percent of all the failures occurred among these students. The general condition with respect to university marks is shown in Figure 5. Curve I is for the students whose I. Q.'s were in the first or highest quarter; curve II is for those whose I. Q.'s were in the second quarter; and so on. The significant

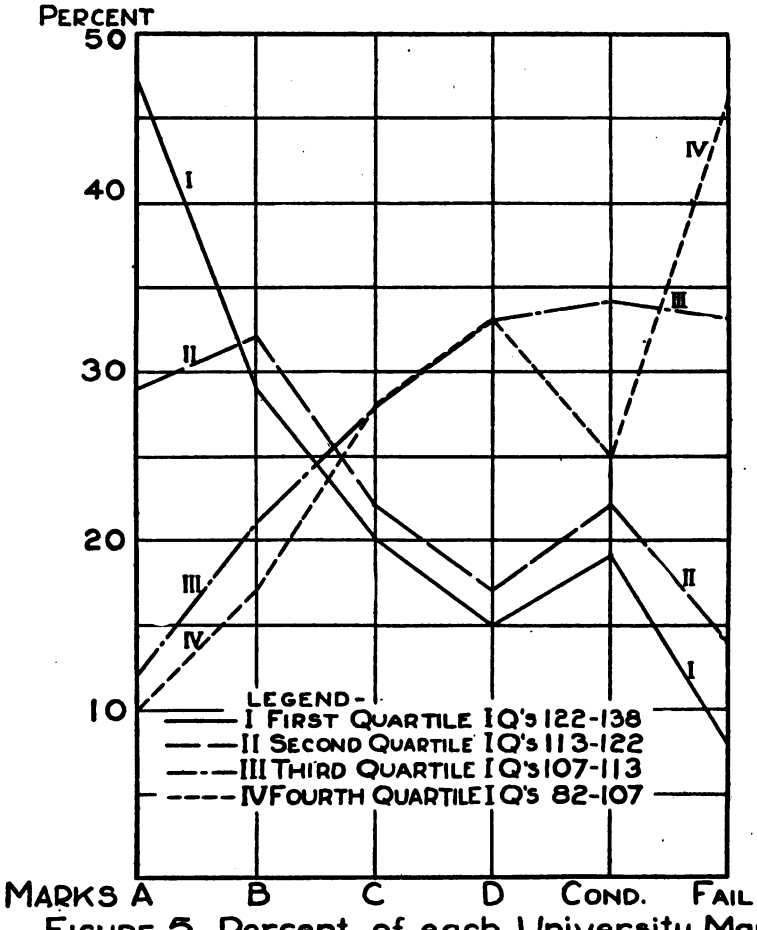

FIGURE 5 Percent of each University Mark received by Quartiles I-IV Data from Table XV

fact to be observed is that curves I and II tend strongly to slope downward and to the right, while curves III and IV slope upward. Indeed, the pairs of curves form a rude X. This X is obscured by two perfectly explainable causes. The first is the tendency to "condition" capable students who have technically failed—generally because of some unusual circumstance. This tendency causes curves I and II to show an irregular rise at the point representing "conditions." The second cause which makes the curves irregular also has to do with the grade of "conditioned." Curve IV drops sharply at this point. Instructors having dull students whose work has not been clearly of passing quality tend to withhold the "condition" and to fail them without reprieve. With these rather easily explainable limitations, Figure 5 makes clear the fact that the high-school students who received the better half of the intelligence ratings secured many high marks in the university and few low ones, and that the exact reverse was true with respect to the high-school students who receive the lower half of the intelligence ratings.

The reader's attention is also directed to the contrast between the figures given in Table XV for the cases above the median (quartiles I and II combined) and the figures for the cases below the median (quartiles III and IV combined). From every viewpoint afforded by Table XV and Figure 5 it appears that the Stanford students with I. Q.'s of 113 to 138 did work in the university that was distinctly superior to the work done by those whose I. Q.'s ranged from 113 down to 82.

The "Critical Score," or Intelligence Level Below Which Success in College is Problematical

The median I. Q. of first-year high-school pupils has been shown to approximate 105, that of high-school graduates 111, and that of those going on to college 116.[7] Table XIV shows the median I. Q. of the 93 university students therein tabulated to be 113. For the purposes of this discussion it will be convenient to divide the I. Q. range into five sections, as follows: I, over 125, superior; II, 110–124, above average; III, 95–109, average; IV, 80–94, below average; V, below 80, inferior or defective.

[7] Chapter II, p. 22.

If the median I. Q. of college freshmen is found to lie between 110 and 116, we would expect, *a priori*, to find that those who tested below 110 would furnish the larger proportion of failures. In Table XIV there are 31 cases where the I. Q. falls below 110. These 31 cases (one-third of the total number) furnish 52 percent of the total number of hours of failure, and 63.1 percent of the total number having scholarship ratings below 1.00, or average. This showing would seem to indicate that in order to do average or better work in college it is necessary to have "better-than-average" intelligence, i.e., an I. Q. of 110 or above.

It should also be remembered that the data gathered in Table XIV represent only the first three quarters of university work, corresponding to the freshman year. If the same process of selection takes place in college that we have shown to take place in high school, we should expect the median I. Q. of college graduates to be 120 or over. This would mean that many of those having just average intelligence, who are able to do the work of the freshman year with a fair degree of success would be likely to be eliminated before the senior year in college. That such would be the case seems to be a fair inference from the scholarship records of those whose I. Q.'s fell below 110 in Table XIV. Those having just average intelligence would occupy the same relative place, so far as elimination from college is concerned, as those having below-average intelligence occupy in the high school.[8] The probability is strong that from 60 to 80 percent of them will be eliminated during the college course.

College Entrance by High-School Marks or Mental Tests?

From the data presented in Table XIV there appears to be a close relation between rank in mental tests and scholarship ratings in university work. A point that needs further discussion is whether mental tests would be as reliable a basis for the selection of college students as the record of four years in high school. Or, to state the problem differently, could the mental tests be safely substituted for the high-school scholarship record as a basis for admission to college?

Tables XVI and XVII show respectively the correlations between intelligence quotients and university scholarship ratings,

[8] See Tables VIA and VIB, p. 20.

and between high-school and university scholarship ratings. It should be remembered that the high-school marks represent ratings based on all marks received during four years of high school; that the university ratings are based on the first three quarters of university work; that the mental tests were given in 1916-1917, while the students were still in high school; and that only one group mental test, the Army Alpha, was employed.

TABLE XVI. CORRELATION BETWEEN INTELLIGENCE QUOTIENTS OF 93 STANFORD UNIVERSITY STUDENTS AND THEIR UNIVERSITY SCHOLARSHIP RATINGS

I. Q.'s by Alpha 1916–1917	University Scholarship Ratings												Totals
	0.00 0.24	0.25 0.49	0.50 0.74	0.75 0.99	1.00 1.24	1.25 1.49	1.50 1.74	1.75 1.99	2.00 2.24	2.25 2.49	2.50 2.74	2.75 2.99	
135–139	.....	.....	.....	.....	.....	.....	.....	2	.....	1	.....	.....	3
130–134	.....	.....	.....	1	1	.....	1	.....	.....	.....	2	.....	5
125–129	.....	.....	.....	1	1	.....	4	1	1	2	1	.....	11
120–124	.....	.....	.....	.....	2	2	.....	1	1	2	2	1	11
115–119	.....	.....	.....	.....	4	3	2	3	1	2	.....	.....	15
110–114	1	1	.....	3	3	3	2	1	3	.....	.....	.....	17
105–109	1	2	2	1	8	1	2	.....	2	.....	.....	.....	19
100–104	.....	.....	1	2	2	.....	1	.....	1	.....	.....	.....	7
95–99	.....	.....	.....	1	1	.....	.....	.....	.....	.....	.....	.....	2
90–94	.....	.....	.....	1	1	.....	.....	.....	.....	.....	.....	.....	2
85–90	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0
80–84	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1
Totals	2	4	3	10	23	9	12	8	9	7	5	1	93

Median I. Q. group, 110–114.
Median scholarship rating, 1.25–1.49.
Pearson coefficient of correlation, 0.495.
Probable error, 0.0526.

In Table XVI there are ten cases where the I. Q. is above the group median, "110–114," and where the scholarship rating is below the group median, "1.25-1.49," but only two of the cases fall below "1.00," which stands for average scholarship.

Below the I. Q. group median there are six cases which show a scholarship rating above the scholarship rating median, but none of these have I. Q.'s below 100.

TABLE XVII. CORRELATION BETWEEN THE HIGH-SCHOOL AND UNIVERSITY SCHOLARSHIP RATINGS

High School Scholarship	University Scholarship Ratings												Totals
	0.00 0.24	0.25 0.49	0.50 0.74	0.75 0.99	1.00 1.24	1.25 1.49	1.50 1.74	1.75 1.99	2.00 2.24	2.25 2.49	2.50 2.74	2.75 2.99	
1.00–1.24	.....	.....	.....	.....	1	.....	.....	1	3	.....	2	.....	7
1.25–1.49	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	3	1	5
1.50–1.74	.....	.....	.....	.....	2	.....	.....	2	1	1	.....	.....	6
1.75–1.99	.....	.....	.....	1	1	.....	1	2	1	2	.....	.....	8
2.00–2.24	.....	1	1	.....	2	3	3	2	1	2	.....	.....	15
2.25–2.49	.....	.....	.....	.....	2	1	3	1	1	.....	.....	.....	8
2.50–2.74	.....	.....	.....	3	4	.....	2	.....	.....	1	.....	.....	10
2.75–2.99	.....	1	.....	.....	5	3	1	.....	1	.....	.....	.....	11
3.00–3.24	2	2	1	3	4	2	2	.....	.....	.....	.....	.....	16
3.25–3.49	.....	.....	.....	.....	2	.....	.....	.....	1	.....	.....	.....	3
3.50–3.74	.....	.....	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	1
3.75–4.00	.....	.....	1	2	.....	.....	.....	.....	.....	.....	.....	.....	3
Totals	2	4	3	10	23	9	12	8	9	7	5	1	93

Median university scholarship-rating group, 1.25–1.49
Median high-school scholarship-rating group, 2.25–2.49.
Pearson coefficient of correlation, 0.615.
Probable error, 0.0445.

In Table XVII there are nine cases of students above the median group in high-school scholarship and below the median group in university scholarship. Three are below "1.00" in university ratings. On the other hand, there are eight who fall below the median in high-school scholarship and who stand above the median in university scholarship. But the general agreement between high-school grades and university work is sufficient to give the relatively high correlation of 0.615.

In discussing an ideal examination of the intelligence of candidates for college entrance, Dr. E. L. Thorndike[9] says that the score should correlate as closely as possible with future achievement in college, and further:

This maximum correlation will not be 1.00, since achievement in college is due in part to health, to freedom from personal worries, and to

[9] Thorndike, E. L. "Intelligence examinations for college entrants," *Journal of Educational Research*, 1:329 May, 1920.

various moral qualities as well as to intellect. . . . Within the restricted range of those who complete a high-school course and actually become candidates, we may expect as a maximum 0.55 to 0.65 possibly more. A correlation above 0.50 is probably an improvement over the attainment of standard systems of accrediting high schools or of entrance to college by examination in school subjects.

In Tables XVI and XVII the correlations between intelligence quotients and university scholarship, and between high-school scholarship and university scholarship were 0.495, P. E. 0.0526, and 0.615, P. E. 0.0445, respectively. That is, the correlation between high-school scholarship and university scholarship is higher by 12 points than the correlation between intelligence quotients and university achievement.

This difference in correlation in favor of the high-school scholarship might seem to indicate that the intelligence test is not as reliable a criterion as the four-year high-school record of scholarship in determining fitness to do college work. Such a conclusion would not necessarily follow. Account must be taken of the fact that the intelligence test given in the case of the 93 students under consideration was given three years prior to the collection of data concerning their college work; that it was a group test, not specifically designed for college students; and that no supplementary tests were given which might have corrected or compensated for errors in rating chargeable to the admitted shortcomings of the Alpha Scale. Consequently Table XIV and the correlation 0.495 represent the accuracy with which the person giving the Alpha test to the pupils of the high schools near Stanford University in 1917-1918 could have predicted their probable high-school and university careers. He would have been able to pick the 50 percent, who would almost surely succeed, and the 50 percent from among whose numbers the great majority of the failures and poor students would be found.

Furthermore, if supplementary group and individual mental tests had been given to these high-school pupils, much more reliable mental ratings would have resulted and the correlation between mental level and university work would have been considerably higher. In support of this contention two cases may be cited, i.e., those ranking 77 and 80 in Table XIV. No. 80 had a high-school scholarship rating of 3.3, having earned an average of

"C+" in all high-school subjects. Her intelligence quotient on Alpha was 105, which is 8 points below the median for the group. When she was in the eighth grade she was given a Stanford-Binet examination and earned an I. Q. of 120, which corresponds more closely than the Alpha I. Q. entered in Table XIV with her university scholarship rating of 2.07. No. 77 had a high-school scholarship rating of 2.2, or about "B." His Alpha I. Q. was 105, but a Stanford-Binet examination taken a year earlier gave him an I. Q. of 115. His university scholarship rating was 2.16.

If the Stanford-Binet I. Q.'s of these two students alone had been used in Table XIV instead of the Alpha I. Q.'s, the median I. Q. for the entire group would have been 115 instead of 113; and the percents of "A" grades, honor points, and high scholarship ratings coming in the upper, or above-the-median group, would have been considerably higher. Likewise, if these two cases had been entered in Table XVI on the basis of the Binet I. Q., the correlation would have been approximately 5 points higher, or about 0.549.

It would probably be impracticable to attempt to substitute mental examinations entirely for records of attainment in high school as a basis for determining admission to college. But on account of the varying standards of marking that prevail in high schools it is impossible to accept an "A" mark given by one school as the equivalent of an "A" mark given by another school. Requiring all applicants for entrance to college to take mental tests would give to the registrar and committee on credentials an objective standard of judgment which would enable them to estimate with greater accuracy the abilities of those seeking admission to institutions of higher learning. Especially would this be true in institutions like Stanford where the number who may attend is limited, and where the number of applicants greatly exceeds the possible number of entrants.

Another advantage of the mental test as a criterion for college entrance is that it makes possible the extension of university privileges to persons of maturity who have not had high-school training. The case of the man having fifth-grade education, but sufficient intelligence and experience of life to profit by and succeed above the average in university work, is only one of many that might be discovered if the universities adopted the policy of

reserving from 1 to 5 percent of their registrations for cases of this kind. Too many mental diamonds, that might otherwise be discovered and polished, now remain in the rough on account of the formal, inelastic entrance requirements of our colleges and universities. Mental tests will minister to a genuine educational need if they help to open the doors of our higher institutions to men and women of marked ability, regardless of their formal academic preparation.

Summary and Conclusions

1. The ability to attain a high score on an intelligence test like the Army Alpha is presumptive evidence of ability to do college work successfully. This is shown in Table XIV by the proportion of "A" marks, honor points, and above-average scholarship ratings earned by the above-the-median group, and by the large proportion of "D's," conditions, failures, and below-average scholarship ratings earned by the below-the-median group.

2. It is possible to suggest a "critical score" or intelligence quotient below which success in college work, or ultimate graduation from college, would be open to question. Since the median I. Q. for college freshmen appears to lie between 110 and 116, and since the highest percent of failures, poor scholarship ratings, and other evidences of lack of ability to do college work successfully are found in the below-the-median group there is good reason to predict that a majority of the eliminations from college will come from those with I. Q.'s below the median for college freshmen.

3. While mental tests may not supplant "recommended" high-school units as a basis for college entrance, it is safe to say that such tests will soon be so well standardized as to become a generally accepted means of making final selection from among those seeking to enter college. Particular value should attach to the use of mental tests as a means of admitting special students to the opportunities and privileges of a university course.

APPENDIX

I. The Kohs-Proctor Mental Age Norms for the Army Alpha Scale

During the year 1917-1918 the Army Alpha Scale was given to several thousand California school children. The children tested were drawn from all types of communities and represented every variety of social status. The high-school pupils, whose scores, school marks, etc., have been discussed in the preceding chapters were among this number.

In dealing with adults, an absolute point scale with the total scores grouped into five or seven sections will give reasonably accurate impressions as to mental level. But in the case of children, most of whom are below sixteen years of age, it is desirable to use the intelligence quotients, or ratio between mental age and chronological age. In order to assign I. Q.'s to the public school pupils who had been examined with the Army Alpha it was necessary to discover mental age norms corresponding to given scores earned on the Alpha Scale.

The writer collaborated with Dr. Samuel Kohs in working out norms that could be employed tentatively in computing correlations between school work, teachers' estimates of ability, and intelligence quotients.

The first step was to find the curve of distribution of scores in the Alpha Test by chronological age groups. The groups covered six months of chronological age, i.e., from 9 years, no months to 9 years, 5 months in one group, and from 9 years, 6 months to 9 years, 11 months in another group, etc. A curve for the median scores made by these chronological age groups was plotted.

It was found that about seven hundred of the children who had taken the Alpha Scale had at one time or another been given the Stanford-Binet individual test. The Alpha scores made by these children were distributed by mental age groups and a curve plotted of the median scores by six-months mental age groups. The two curves were found to correspond quite closely. There was a variation of from twelve to twenty points on the absolute

scale to cover a mental age or chronological age year. For the years where there were at least 100 cases in each six-months chronological age group the number of points on the scale necessary to cover a mental age year varied only from 13 to 17.

It was found that by allowing 15 points on the Alpha Scale for each mental age year, and starting with "0" score on Alpha as equivalent to a mental age of 9 years 0 months, a correlation of over 0.90 between Stanford-Binet I. Q.'s and Alpha I. Q.'s was obtained.

Table XVIII gives the corresponding mental age norms according to the Kohs-Proctor results and the results obtained by the Division of Psychology, Surgeon General's Office of the Army. Figure 6 is a graphic representation of the two sets of norms.

The Army psychology norms were worked out on the basis of Stanford-Binet and performance tests given to army recruits who had also taken the Alpha Scale. Because the highest mental age attainable on the Stanford-Binet is 19 years, 6 months, the curve for these norms begins to be more and more depressed as mental age 19—6 is approximated. Up to age 18—0 the Army psychology mental ages approximate one year higher for a given score on Alpha than the Kohs-Proctor mental ages. The curves cross at age 18—0 and thereafter the Kohs-Proctor norms show a higher mental age for a given Alpha score than do the Army psychology norms.

In Figure 6 the Kohs-Proctor norms conform to a straight line, because when it was found that 15 points on the Alpha Scale corresponded most nearly to a mental age year (the "cut and try" method of arriving at this approximation being employed) the "zero" point, or point below which the median score of the children was "zero" was taken as the starting point. This was found to be 9 years, 0 months. From this point ascending twelve points on the perpendicular for every fifteen points on the horizontal axis, the line was drawn.

These norms have been applied to the Alpha scores of over 2,000 high-school pupils and to many grade children. About 40 percent of these pupils have been given the Stanford-Binet; and the correlations obtained between Binet I. Q.'s and Alpha I. Q.'s range from 0.80 to 0.92.

TABLE XVIII. MENTAL-AGE EQUIVALENTS OF ALPHA SCORES, ACCORDING TO KOHS-PROCTOR AND ARMY PSYCHOLOGY NORMS

Army Ratings	Alpha Scores	Mental Ages According to	
		Kohs-Proctor Norms	Army Psychology Norms
D−	0	9—0	9—0
	5	9—4	9—6
	10	9—8	10—0
D	15	10—0	10—6
	20	10—4	11—0
C−	25	10—8	11—6
	30	11—0	12—0
	35	11—4	12—3
	40	11—8	12—6
C	45	12—0	13—0
	50	12—4	13—3
	55	12—8	13—6
	60	13—0	14—0
	65	13—4	14—3
	70	13—8	14—6
C+	75	14—0	15—0
	80	14—4	15—3
	85	14—8	15—6
	90	15—0	16—0
	95	15—4	16—3
	100	15—8	16—6
B	105	16—0	16—9
	110	16—4	17—0
	115	16—8	17—2
	120	17—0	17—4
	125	17—4	17—6
	130	17—8	17—9
A	135	18—0	18—0
	140	18—4	18—3
	145	18—8	18—6
	150	19—0	18—8
	155	19—4	18—10
	160	19—8	19—0
	165	20—0	19—2
	170	20—4	19—4
	175	20—8	19—6
	180	21—0	19—8
	185	21—4	20—0
	190	21—8	20—4
	195	22—0	20—6
	200	22—4	20—8
	205	22—8	20—10
	210	23—0	21—0

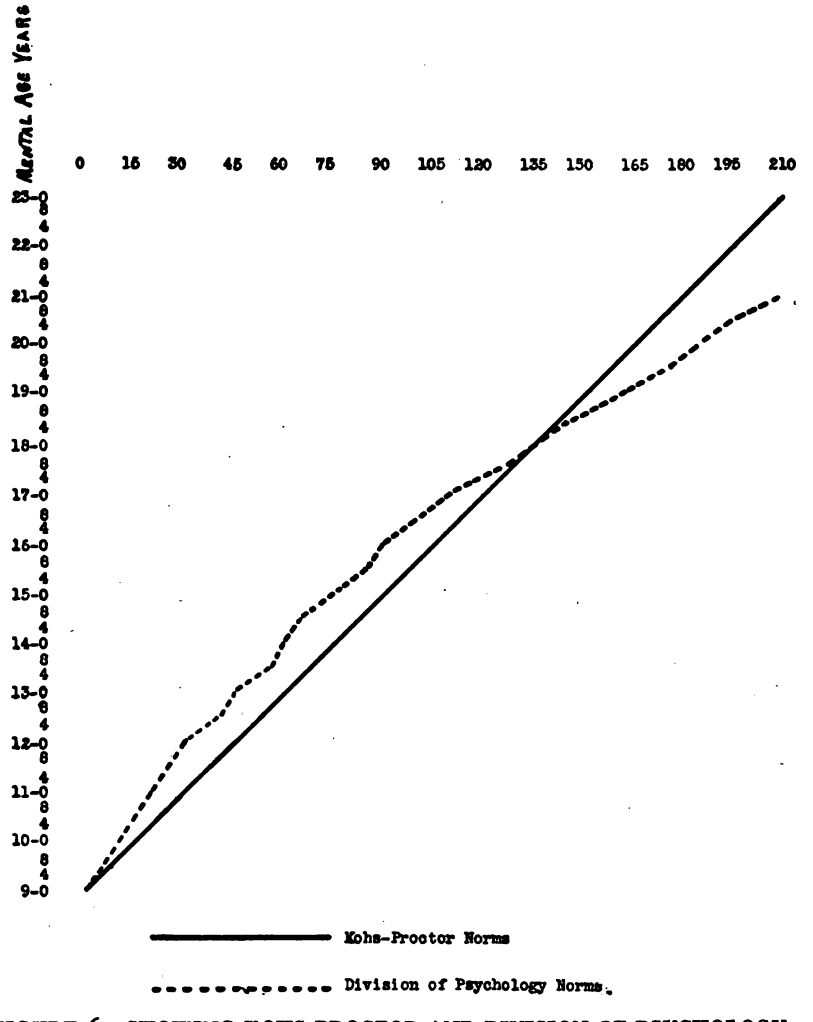

FIGURE 6. SHOWING KOHS-PROCTOR AND DIVISION OF PSYCHOLOGY, SURGEON GENERAL'S OFFICE, U. S. A., MENTAL AGE NORMS FOR ALPHA SCALE

II. Mental Tests Available for the Examination of High-School Pupils

1. *The Stanford-Binet.*—This is the Stanford Revision of the Binet-Simon Scale. It makes possible measurement of mentality

up to 19 years, 6 months, and on that account is better adapted to the testing of high-school pupils than any other revision of the Binet Scale that has been published. Record booklets, test-materials, score cards, etc., as well as Dr. Terman's book, *The Measurement of Intelligence*, which should be mastered by any one who undertakes to give the Stanford-Revision, can be secured from Houghton Mifflin Co., Boston.

2. *The Alpha Group Test, Army Scale.*—This was the group test developed by the Division of Psychology, Surgeon General's Office, U. S. Army and employed in the examination of nearly two million men. It consists of eight separate tests and has a total possible score of 212 points. It can be given to several hundred persons at once, requires about 45 minutes, and can be scored mechanically by trained clerical workers. Examiners' guides, test booklets, etc., can be had in quantity from the Bureau of Standards and Measurements, State Normal School, Emporia, Kansas.

3. *The Terman Group Test of Mental Ability.*—This test has been developed and standardized by Dr. Lewis M. Terman, Professor of Educational Psychology, Stanford University, joint author of the National Intelligence Tests and of the Army Tests; also author of the Stanford-Revision of the Binet-Simon Scale and books on the measurement of intelligence. This is the only test yet published which is especially adapted for pupils of high-school grade. It may also be used successfully in grades six, seven, and eight, and in the first year in college. The test is issued in two separate forms, Form A and Form B, each of which contains 185 problems or questions. Manual of Directions gives full information for giving and scoring the tests. Sold in packages of 25, including Manual of Directions and Scoring Key, by the World Book Company, Yonkers-on-Hudson, New York.

4. *The Otis Advanced Group Intelligence Scale.* The Otis tests were among the first comprehensive group tests to be published before the Army Alpha Tests were released for general use. Mr. Otis had done more than almost any other psychologist in the development of group tests at the time of the organization of the Division of Psychology, U. S. Army. Many of the tests which he had already perfected were adopted as part of the Army group examinations a and b and Alpha. The Otis tests consist of ten

well-selected tests arranged in booklet form, and published, with Manual of Directions, instructions for scoring etc., by the World Book Company, Yonkers-on-Hudson, New York. These tests are also put up in packages of 25.

5. *Thorndike's College Entrance Test.* The original tests of the series of college entrance tests now being developed by Dr. Thorndike consisted of two forms, Form A and Form A1. Form A was made up of a series of 13 tests, the first ten of which were very similar to the 10 tests of the first Army Scale, Examinations *a* and *b*, with a "True-False," a "Memory" for geometrical forms, designs and numbers, and a "Logical Reasoning" test in addition. Form A1 consists of nine tests, all involving a knowledge of literature, history, science, mathematics, etc., that every high school graduate is presumed to have. It is Dr. Thorndike's purpose to develop new tests or series of tests often enough to prevent coaching on the specific items. High correlations between the intelligence scores earned on the Thorndike College Entrance Tests and subsequent work in colleges and universities have already been found. These tests are published by the Bureau of Publications, Teachers College, Columbia University, New York, N. Y.

Final Word

Any one undertaking to apply group mental tests to high-school pupils should first familiarize himself with the tests to be given, the procedure as outlined and standardized by the author or authors of the tests, the methods of scoring and interpreting results. If possible, two different tests, such as the Alpha and Terman Group tests should be given and the results compared, or the scores equalized in some manner. Results obtained should be considered as tentative and not absolute. Every effort should be made to determine the validity of the tests employed and to discover the true mental level of each person examined.

Applied by trained examiners, scored by expert assistants, verified by all available means and considered as reasonably reliable approximations of the mental levels of the persons examined, individual and group mental tests will be found to be of invaluable assistance to secondary teachers in the educational and vocational guidance of high-school pupils.

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